Shannon A. Walker. From Science to Librarianship: Career Motivations of the Scientist-Turned-Librarian. A Master's Paper for the M.S. in L.S degree. April, 2010. 119 pages. Advisor: Joanne Gard Marshall.

Why might someone with science training pursue an information career? This secondary analysis of the Workforce Issues in Library and Information Science (WILIS) study compares those who earned a natural science degree prior to the LIS program with others who did not. The results point to more similarities than differences. All LIS graduates showed broad agreement on job motivations, values, and satisfaction; however, some differences were found. Science majors were less interested in school libraries and more in special libraries. Scientists were more likely to self-identify as "information professional" alone or in tandem with "librarian" and more likely to cite computer interest as one motivation. Science graduates were significantly more likely to claim responsibilities for academic research and publications, database development, and "other" IT and consulting. Very few entrants to LIS programs have science degrees, but the potential exists to attract more.

Headings:

Surveys/Librarians

Librarians/Careers

Librarianship as a profession

Special librarianship

Science librarians

FROM SCIENCE TO LIBRARIANSHIP: CAREER MOTIVATIONS OF THE SCIENTIST-TURNED-LIBRARIAN

by
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A Master's paper submitted to the faculty
of the School of Information and Library Science
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Approved by

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Joanne Gard Marshall

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It is rare that one manages to engage in a voyage of personal discovery and academic research at the same time. I have been very fortunate in this project to have done so, and to have received tremendous support from a number of individuals past and present that brought me to this place. Some but not all of these individuals are associated with the School of Information and Library Science (SILS).

I was introduced to the Workforce Issues in Library and Information Science (WILIS) project as Graduate Research Assistant for SILS Professor Joanne Gard Marshall at the UNC Institute on Aging. I cannot begin to thank her enough for her willingness to provide me with substantive assignments in that role and for her nourishment of my growth as a professional. I know that dealing with a strong-willed individual such as myself can be a real challenge, and we have had many stimulating conversations!

The WILIS team has gone the extra mile for me personally and professionally, and I thank them all. Susan Rathbun-Grubb endured my vacillations and ruminations and provided inspirations. Jennifer Craft Morgan introduced me to qualitative methodologies and exhibited a refreshing Zen-like calm in the midst of chaos. Cheryl Thompson proved that the little things really do add up to something big; I hope she knows she isn't taken for granted. Deborah Barreau took the role of advisor to a new level, and I thank her.

I'd also like to thank the WILIS participants for sharing their life stories. Without their generosity, this work would never have been possible. Such a large undertaking

could also never have happened without significant funding and a strong research team. The WILIS 1 and 2 studies were supported by grants from the Institute of Museum and Library Services (IMLS). The primary research team from the School of Information and Library Science at UNC Chapel Hill and the UNC Institute on Aging consisted of Joanne Gard Marshall, Lead Principal Investigator; Victor W. Marshall, Co-Principal Investigator; Jennifer Craft Morgan, Co-Principal Investigator; Deborah Barreau, Co-Investigator; Barbara Moran, Co-Investigator; Paul Solomon, Co-Investigator; Susan Rathbun-Grubb, Graduate Research Assistant; and Cheryl A. Thompson, Project Manager.

My choice of topic for this work was inspired as much by navel-gazing as by academic rigor. Thirteen years ago I was a chemistry graduate looking for direction, and UT Chattanooga professor Tom Rybolt put me in contact with Virginia Brown at Chattem, who took a chance and offered me a job as a solo librarian. She went on to serve as mentor and friend even after I moved to other roles within the company and beyond. She has seen me go from scientist to librarian to various iterations of scientist and now back to librarian again, and I'd like to thank her for her wit and her grit over the years.

Finally, what can I say about patience? My dear husband Andrew completely understood when I wanted to toss aside a very good salary and go back to school. I am invigorated that I will be able to enjoy all of my passions: the life of the mind, the thrill of the hunt, and the love of my life.

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Introduction

> *"Many students, particularly women—for whom job opportunities in the sciences are usually not as attractive as for men—may find careers in the literature of chemistry more rewarding and interesting than careers in the laboratory." (Waddington, 1962, p. 196)*

> *"The shortage of science librarians, however, is not a new phenomenon. There has been a shortage since the 1950s, or earlier, and yet the problem has still not been adequately resolved." (Pellack, 2007, p. 55)*

> *"Excellent interpersonal and communication skills, ability to work well with colleagues, enthusiasm for the profession, and management and leadership skills are essential to the librarian in the fast-changing world of library and information technology. Enlightened library administrators of the future will look for and prefer these capabilities, mindful that relevant knowledge about science can be learned. It is much more difficult to teach a new librarian how to work on a team or get along with his or her peers. Though some progressive sci/tech librarians and directors realize this, most have not yet adopted this view." (Storm & Wei, 2007, p. 38)*

What might trigger someone with science training to forgo the lab to pursue a non-traditional career in librarianship? In light of a wave of baby boomer retirements, many are projecting labor shortages for librarianship in general, and already existing shortages will likely worsen for science librarianship. (Marshall, Solomon, & Rathbun-Grubb, 2009; Heim K. M., 1988) Increasing diversity of background for library program recruits might be important not only for filling science specialist positions, but also for injecting different perspectives and skills into the field as a whole. Are science graduates so lacking in social motivation and interpersonal acumen that it would be easier to teach a poet technical nomenclature than to guide a chemist to conduct a conversation? Are opportunities in science always more lucrative than in Library and Information Science

(LIS)[1] work? By learning the values and experiences of scientists who have already become librarians, we can get to the truth behind the stereotype of the scientist-turned-librarian. Should the truth prove worthy, perhaps such understanding could be used in recruiting others with science background to take this unconventional path to a rewarding career.

Background

The American Library Association (ALA) has noted a long-standing shortage of librarians with science, business, or engineering background, and others have noted that in the absence of improved recruiting the situation will only worsen due to an aging workforce. (Heim K. M., 1988; Kim, Chiu, Sin, & Robbins, 2007; Level & Blair, 2007) Nearly a third of physical science librarians responding to a survey conducted by Ortega and Brown (2005) had more than 20 years experience in the field, while another third had 11-20 years. Winston (2000) found that 60% of science-technology librarians were older than 45. In Hooper-Lane's (1999) research, 46% of chemistry librarians claimed more than 11 years experience. In previous studies, only about 5-6% of library students held an undergraduate degree in science. (Brown L. B., 1988; Moen, 1988) The draw of science majors to specialized subject librarianship is strong but not automatic. While 47% of science librarians in Hackenberg's (2000) study stated a desire to be a science librarian *because* of subject background, interestingly, another 14% did not originally seek science library work but eventually reconsidered.

[1] See the appendix for a glossary of acronyms used in this paper.

The high average age for librarians reflects in part the fact that many librarians enter the field as a second career. (Lipscomb, 2003) Career change is impacted by many variables, including dissatisfaction with the current career, anticipated benefits of a new career, and personal/family context. (Rhodes & Doering, 1983) Many previous studies of librarian career motivation comprised multiple-choice questionnaires of anticipated benefits for the field as a whole without putting them into context of personal history, personality preferences, and interpersonal needs. (Ard, et al., 2006; Gordon & Nesbeitt, 1999; Kim, Chiu, Sin, & Robbins, 2007; Matarazzo & Mika, 2006; Moen, 1988) Some researchers, however, have recognized that personality differences can influence the selection of different job settings (e.g., academic versus public), functions (children's services versus cataloging), membership organizations (American Library Association [ALA], American Society for Information Science and Technology [ASIST], or the Special Libraries Association [SLA]), or degree type (library science [LS], library and information science [LIS], or information science [IS]); they have compared work values or job satisfaction across one or more of these different groups. (David & Scherdin, 1994; Duff, Cherry, & Singh, 2006; Scherdin, From children's, 1994; Scherdin, Librarians and information, 1994; Scherdin, Vive la difference, 1994; Williamson, Pemberton, & Lounsbury, 2005) Given that the typical science major shows different personality traits compared with the typical humanities major (Huang & Healy, 1997; Myers & Myers, 1995), one might expect that career motivation differs as well; some studies have compared work aspirations, values, and satisfaction by major. (Horn & Zahn, 2001)

The perennial shortage of qualified candidates to serve as science librarians has led to studies of that group, but such studies have three limitations for our purposes. First, most

included all those working in science libraries, not only those with science background. Second, almost all were distributed via listserv, limiting ability to generalize to those not active in such forums. Third, most exclude those science graduates who chose to work in other types of libraries, those who become "embedded" information workers less strongly identifying with LIS, or those who left the field entirely. Many researchers have vigorously debated whether a science degree is absolutely necessary for science librarianship, but they agree that domain knowledge, including continuing education, is beneficial for search performance and prestige/rapport with patrons. (Hallmark & Seidman, 1998; Krietz & Devries, 2007; Bowden & Olivier, 1995; Charton, 1992; Morris-Knower, 2001; Petersen & Kajiwara, 1999)

Those with science backgrounds are not only of use in subject specialized libraries. Patrons in all types of libraries have questions about the sciences. When such questions arise, librarians without much domain knowledge may face what Belkin (1980) called an anomalous state of knowledge, where they "don't know what they don't know." As explained by one academic librarian who gave "bootstrap training" to humanities majors working the reference desk, "Fear of science can be exacerbated when non-science librarians work with non-science majors. Neither party has an extensive subject background and neither may be able to formulate flexible search strategies." (Petersen & Kajiwara, 1999) With training, non-specialists may adequately serve students, particularly undergraduates, although chemistry librarianship might be an exception to this. (Hackenberg, 2000; Tchangalova, 2009) The knowledge gap among disciplines is not symmetric; science majors typically take twice as much coursework in the humanities as humanities majors take of math and science. (Brown L. B., 1988)

Some researchers have examined factors motivating people to choose science librarianship. (Eells, 2007; Beck & Callison, 2007; Hackenberg, 2000; Hallmark & Lembo, 2003) Several studies have found that former scientists represent a far larger proportion of science librarians than the 5-6% of librarians as a whole, finding also that biologists and chemists are more represented than physicists and engineers. (Hallmark & Lembo, 2003; Hooper-Lane, 1999; Ortega & Brown, 2005; Winston, 2000)

As the rhetoric has asserted for some time, the well-paid sciences are not "job-starved disciplines like history, English, American Studies, and other departments than have an overload of graduates for the number of available positions." (Ard, et al., 2006) In 1983 an Associate of Research Libraries (ARL) librarian with five years experience typically earned less than an entry-level (bachelor of science, BS) science job. (Bidlack, 1983) Yet the current picture may be more nuanced. Horn and Zahn's (2001) longitudinal study found that salaries for both bachelor's-only humanities and biology majors were significantly lower than the average bachelor's-only salary five years after earning the degree. Financial prospects differed significantly by gender as well. While male scientists and mathematicians made healthy salaries, earnings for females with humanities and biology majors were low and comparable to one another.

Factor(s) other than salary seem to come into play in career change for scientists, as shown in several studies. Of science and engineering graduates out of college more than 5 years before taking the Graduate Record Exam (GRE) and presumably preparing to enter graduate studies, 0.8% were pursuing library science and only 61% were continuing in science. (Grandy, 1998) Those who left science (albeit mostly to pursue health/education work) were more engaged in community service and expressed a strong

interest to work with people. Leavers valued having a variety of tasks more but technical challenge and opportunities for advancement less than those who remained. Farmer, Wardrop, Anderson, & Risinger (1995) found that women most committed to career growth were most likely to leave science-related careers for other fields. Female science majors with greater self-efficacy and less perceived role conflict show higher career aspirations. (Nauta, Epperson, & Kahn, 1998)

Practicing librarians do not appear to be engaging sufficiently often or effectively in outreach to scientists, and this might adversely affect recruitment. Hallmark and Lembo (2003) found that "the most compelling, consistent theme running through the comments of scientists-turned librarians was that they had no idea that the LIS profession was so interesting, challenging, and enjoyable, nor were they aware of the revolution brought about by information technology."

Two studies limited to former scientists who became librarians both relied on email discussion lists for recruitment. Former health scientists found that "going into medical librarianship allowed them to stay in the health care field but with better hours, better quality of life, more pleasant environment, less stress, and no patient care responsibility." (Fikar & Corral, 2001) Of science librarians in another study, 67% of those with science degrees held only a bachelor's, usually in chemistry or biology. Only a quarter had left science because they were dissatisfied with their previous career; most were "pulled" by positive qualities of librarianship such as autonomy, quality of work life, and the intellectual challenge and social rewards of working on a research team. (Hallmark & Lembo, 2003)

Better understanding of career motivation can come from examining a wide range of career motivating factors for a large set of LIS graduates. Salary and basic job security are not enough; people have needs above and beyond survival and security, including social needs, esteem needs, and for some, the opportunity for self-actualization. (Maslow, 1970) In a classic article in the **HARVARD BUSINESS REVIEW**, Herzberg asserted that improving work policies, salary, quality of management, and interpersonal interaction can only accomplish so much. Herzberg called such maintenance of the work environment the fulfillment of "hygiene" needs that prevent dissatisfaction, bringing workers to a point of neutrality but not to a positive affect. Satisfied workers are motivated by factors intrinsic to the job itself, such as opportunities for accomplishment and advancement, recognition of effort and a job well done, and the character of the work itself. (Herzberg, 1968)

Career values must also be balanced in context of the "linked lives" of family members. (Marshall, Rathbun-Grubb, & Marshall, 2009) Family responsibilities and dual careers may place limits on working hours, travel, or relocation, which in turn can set bounds on realistic opportunities for compensation and advancement.

Factors influencing the decision to change career are reviewed by Rathbun-Grubb (2009) in a discussion of reasons people left librarianship; her analysis of occupational turnover is particularly salient as it is drawn from the same data set as this paper.

An optimal survey would incorporate assessment of all these factors for a diverse and large sample of librarians, would facilitate comparison of science graduates with others, and would reflect a life's course of decisions, not only a single day's opinions.

Purpose of this analysis

By studying the career patterns and motivations of scientists who became librarians, and by comparing/contrasting them with patterns for the "average" librarian (typically a liberal arts or education major), we can accomplish several goals. We can

- broaden perspective on the benefits of a career in librarianship,
- learn what aspects of librarianship specifically attract science graduates; and
- translate research into practice recruiting a diverse workforce of the future.

This paper uses data from the Workforce Issues in Library and Information Science (WILIS) study conducted at the University of North Carolina at Chapel Hill from 2005-2009 under the direction of Joanne Gard Mashall, Principal Investigator. While prior studies have been weighted toward academic science librarians (of any undergraduate major) who participate in listservs, conducting a secondary analysis of WILIS data facilitated assessment of a wide variety of factors over a more diverse sample of science graduates with LIS degrees, including those who do not work in science libraries.

Data source

The WILIS study (Marshall, et al., 2009) surveyed librarians of all undergraduate majors who graduated from five North Carolina LIS master's programs; the study was unique in that it targeted all alumni, including workers from all types of libraries and those who had left the library field altogether. The survey instrument was designed collaboratively by librarians and sociologists with expertise in workforce issues, helping to ensure validity. Extensive multiple-choice measures of career satisfaction and motivation were supplemented by free-text items. The survey also included reporting of

educational background and position held before pursuing the LIS degree. A number of the WILIS measures were derived from the Workforce Aging in the New Economy (WANE) study, in which some of the WILIS investigators were involved. (McMullin & Marshall, 2010)

In the present supplemental analysis, respondents were coded for a binary variable which reflected at least one “pure science” degree (i.e., excluding applied sciences such as engineering, health science, or science education.) Further details are given in the Methods section which follows.

Research questions

The following research questions formed the focus of this analysis:

1. What are the similarities and the differences in factors motivating the decision to seek an LIS career for individuals holding undergraduate degrees in the natural sciences versus those who do not?
2. Which factors linked to anticipated and experienced job satisfaction were valued differently by scientists who became librarians?
3. Are scientists-turned-librarians more likely to seek employment in certain types of libraries (e.g. academic versus school) and in certain roles? Which environments and roles are most attractive to them? What does this tell us about perceptions of library types and roles?

Methods

Research design

The WILIS study had 2,653 respondents who received LIS degrees in North Carolina between 1964 and 2007, a 35% response rate. Invitation was via postal mail and email which provided the web address for the survey. Methodological details may be found in a toolkit (Workforce Issues in Library and Information Science Team, 2008) and in several articles devoted to the study appearing in a special issue of **LIBRARY TRENDS**. (Marshall, Solomon, & Rathbun-Grubb, 2009)

The web-based survey was quite long, 98 pages when printed, and covered the following topics:

- Education (Section A)
- Career Outline (Section B)
- Job Detail (Sections C, D, E, F, G, H, I)
- Life and Work (Section J)
- Overall Career (Section K)
- Continuing Education (Section L)
- Future of LIS (Section N,M, P, Q, R)

For details on the wording of specific questions and the skip patterns used, the reader is referred to the full survey instrument, available online. (Workforce Issues in Library and Information Science Team, n.d.)

Data subset

Specific degrees held were recorded in a series of questions, thus several variables in the survey could hold the free-text undergraduate major field. The author reviewed the full list of majors for each respondent and hand-coded each as a binary variable: presence or absence of a pure science degree earned prior to the LIS degree. In addition, a column was hand-coded to classify respondents who held a science degree by the type of science as given below.

During the first round of recoding, columns A11a-15a (holding the text response for each degree's major) were examined; subjects were classified into the following groupings: physical science, math, life science, earth science (including environmental science), and others. During the review/coding of the Degree: Highest Science column, potential science candidates were verified individually to exclude miscoded individuals (e.g., science education/educational technology marked not science.) Ambiguous cases were resolved in favor of scientific status (e.g. "biology/teaching cert" respondent with a BS degree was classified as life science since the student could have received dual degrees/double major.) Degrees pursued but with missing end dates were included. The science degree need not have been the degree immediately prior to the MLIS; however, to focus on the concept of leaving science for LIS, only degrees prior to the LIS were counted. It should be noted that some respondents entered degrees out of sequence, so all had to be verified for timing.

For the purposes of this analysis, only those holding at least one degree in the so-called pure natural ("hard") sciences were classified as "scientists": life science, environmental science, physical science, earth science, and mathematics. Those earning

science degrees often held additional degrees or double-majors in other fields. Not included in the "scientists" group for the present study were those in other sciences, including applied scientists with majors such as engineering, health science, computer science, social sciences, and science education. These applied scientists might be expected to differ from the typical LIS graduate as well, but the question will be left for another study. [For a very few questions, explicitly noted, exceptions to this rule were made to include applied scientists as well. Unless otherwise specified, "scientists" refers only to natural scientists as described above.] Based on prior literature, 5-6% of respondents were expected to be natural science graduates, or approximately 130-150; the actual figure of 133 fell within this expected range.

Data analysis

Although items throughout the survey were included in this supplemental analysis, focus was heaviest on the following areas, comparing responses of those in the "science" group to the remainder:

- reasons to seek an LIS career
- relative importance of work values
- factors contributing to anticipated and experienced job satisfaction (overall career values, characteristics of job prior to seeking the LIS degree, and characteristics of current job)
- preferred and actual specialization/work setting

In addition, qualitative responses related to the above factors were examined for science graduates only, both to triangulate findings from statistical comparison and also to discover any factors not captured well by other questions.

Due to the unusual length of the WILIS survey, qualitative responses were generally brief, with survey fatigue explicitly noted by several respondents. After initial skimming

of responses, the return from planned qualitative coding with NVivo software was judged not worthy of the investment of effort that formal coding would have required.

Statistical analysis was conducted using SAS JMP software, version 7. Most questions consisted of Likert-scale responses; analysis of such categorical data was performed via chi squared analysis, citing JMP-calculated Pearson p values for statistical significance. The customary $p=0.05$ minimum criterion for statistical significance was followed. As the number of respondents to each question decreased, statistical power was reduced so that differences of some magnitude could not be classified as statistically noteworthy. In addition, skip patterns meant that not every respondent received every question. The reader is recommended to consider sample size for each question in interpreting results. On the other hand, one should also note that there has been no reduction of significance level to account for multiple comparisons (e.g., Bonferonni adjustment), primarily due to the complexity of calculation in the context of the WILIS survey.

Statistical results in the text which follows are coded with the WILIS survey question number, except for coded columns which will carry no such number.

Analysis Results and Commentary

In order to facilitate understanding, responses have been grouped by conceptual categories rather than the sequence of the survey. For example, the importance of salary might be assessed as a general value, as reason to leave the job prior to seeking the LIS degree, and as important in the current job.

Due to the number and variety of topics covered in this analysis, literature pertinent to specific variables will be discussed in context rather than left for a separate discussion chapter. Integrative discussion for observations across variables, and implications of such, will be left for the final chapter.

Demographics

In comparing those with and without a degree in the sciences, it is important to make sure that any differences that arise are not artifacts of demographic differences between the two groups. Before beginning comparisons, then, let us compare demographics.

Age

Age at graduation

Compare the distributions for age at receipt of LIS degree for scientists, on the right, with all others on the left.

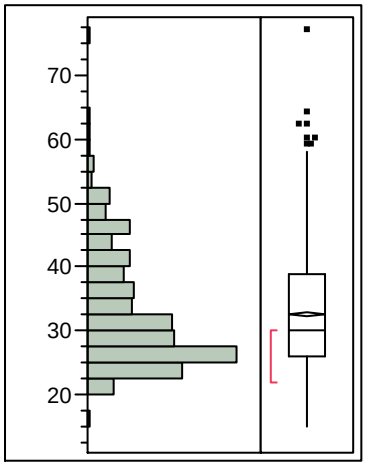

Figure 1: Age at Graduation: Others

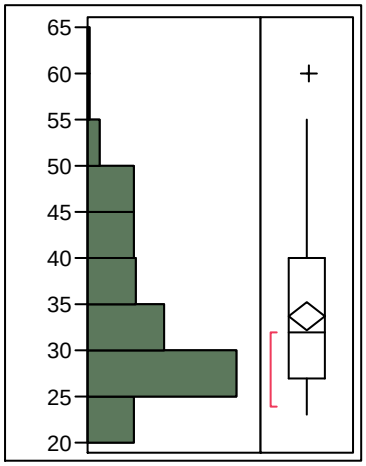

Figure 2: Age at Graduation: Scientists

In both cases there was a skewed distribution with a mode in the late twenties and a median in the early thirties. Science graduates completed the LIS degree at a mean age of 34 (median 32), while others graduated at a mean age 33 (median 30.) These differences are not statistically significant. Age at graduation need not be considered a confounder in comparisons of scientists with others.

Age at survey completion

When considering age at survey completion, however, differences do emerge. Science graduates were slightly younger than others, on average 48 versus 50. Differences of such small magnitude are unlikely to place the groups at different life stages.

Oneway Analysis of Age By Nat-Sci/Others

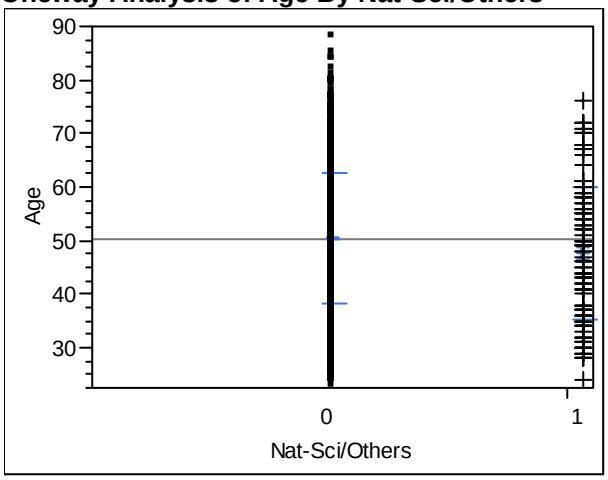

Figure 3: Age at Survey Completion

Missing Rows
41

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Others	2481	50.3527	12.1315	0.2436	49.875	50.830
Scientists	131	47.5496	12.3258	1.0769	45.419	49.680

Wilcoxon / Kruskal-Wallis Tests (Rank Sums)

Level	Count	Score Sum	Score Mean	(Mean-Mean0)/Std0
Others	2481	3264943	1315.98	2.796
Scientists	131	147636	1126.99	-2.796

2-Sample Test, Normal Approximation

S	Z	Prob>|Z|
147635.5	-2.79624	0.0052

1-way Test, ChiSquare Approximation

ChiSquare	DF	Prob>ChiSq
7.8193	1	0.0052

Older respondents experienced a highly gendered society for much of their lives, and librarianship was and remains a gendered profession. The frequency with which women pursued a science degree has been constrained and still remains so in certain fields of science.

Gender

Although men pursue degrees in the sciences with greater frequency than women, the gender proportions of librarians with and without science degrees are similar. Differences

are not statistically significant. As a result, gender need not be considered a confounder in comparisons between the large groups, although some questions are in fact gendered in their response.

A20: What is your sex?
Frequency

	Male	Female	Responses
Others	442	2053	2495
Scientists	30	102	132
-All-	472	2155	2627

Share of Responses

	Male	Female	Responses
Others	0.1772	0.8228	2495
Scientists	0.2273	0.7727	132
-All-	0.1797	0.8203	2627

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	2.0140	0.1559
Pearson	2.1365	0.1438

Gender and disciplinary differences within the sciences

It is known that graduation rates differ by gender among the sciences. While qualitative sciences such as life and earth sciences now succeed in attracting women, there still remain large gender gaps in the more quantitative sciences such as math, physics, and chemistry. Such imbalances can negatively affect the ability of women to feel welcome and even their self-perception. For instance, personal ability and role-models more strongly influenced self-efficacy for women studying the male-dominated physical sciences as compared with the more gender-equal biological sciences. (Nauta, Epperson, & Kahn, 1998)

Despite being a minority in the quantitative sciences, women represented the vast majority of scientists-turned-librarians. The trend did not hold equally for all types of science, however. Earth and environmental sciences showed more balance. Has the growth of GIS made librarianship more lucrative to men? The answer is unclear.

Sci Degree before LIS? (Nat Sci only)

Frequency

A20: What is your sex?	Earth Sci	Life Sci	Math	Phys Sci	Responses
Male	10	6	9	5	30
Female	11	55	21	15	102
.	21	61	30	20	132

Share of Responses

A20: What is your sex?	Earth Sci	Life Sci	Math	Phys Sci	Responses
Male	0.3333	0.2000	0.3000	0.1667	30
Female	0.1078	0.5392	0.2059	0.1471	102
.	0.1591	0.4621	0.2273	0.1515	132

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	14.0648	0.0028
Pearson	14.1435	0.0027

Degree earned: Scientific specialization

As shown in the table above, for the WILIS set significantly more scientists who became librarians had a background in the life sciences versus the other sciences.

As mentioned in the introduction, salaries for bachelor's level biologists, particularly for women, are somewhat low. After controlling for variables other than major (demographics, parental education, grades), biologists were more likely ($p<0.05$) to pursue some form of graduate study than any other undergraduate major. (Nevill & Chen, 2007) LIS faces stiff competition, however. Between 5 and 10 years after the bachelor's, biologists find it easy to transition to careers in the health care field with little additional training and much higher incomes, and many make that choice; half of the biologists in one study who were working as researchers/scientists (presumably in a lab) five years after receiving the bachelor's had transitioned to health careers five years later. (Choy & Bradburn, 2008)

Surveys of science librarians have showed inconsistent shares of biologists and chemists, but these two majors seem to dominate the pool of scientists-turned-librarians.

The survey sample may make an important difference. It is possible that academic science librarian surveys over- or under-represent chemists. With respect to the WILIS data set, North Carolina programs might attract a slightly different mix of majors than the national sample. For instance, while the University of North Carolina offers a certificate in bioinformatics (http://sils.unc.edu/programs/certificates/bioinformatics.html), Indiana University offers a program in chemical informatics (http://cheminfo.informatics.indiana.edu).

Hallmark and Lembo (2003) reported results of a survey of 194 librarians with science or engineering degrees, recruited via science librarian discussion lists, and found that for 67% their highest science degree was a bachelor's; 25% had a master's and 8% a PhD. The most frequent background represented was chemistry at 36%; 30% had a background in the life sciences and 22% had majored in geology. No other science contributed more than 10% of the sample.

Winston's (2000) survey of Association of College and Research Libraries (ACRL) Science and Technology Section members found a similar affinity of biologists and chemists for science librarianship; 20% of those surveyed had a biology bachelor's degree, 12% physics or chemistry, and only 3% engineering. The only other major to top 10% was history (11%). Since nearly a third indicated that they entered librarianship after having held a professional or paraprofessional position in sciences or engineering, librarianship is clearly a second career for many science graduates.

Most respondents (63%) to a survey of physical science librarians majored in a science field as undergraduates; of these, 37% were in chemistry/biochemistry, 18%

biological sciences, 13% physics/astronomy, and other fields each made up less than 10%. (Ortega & Brown, 2005)

Beaubien (2007) has noted the strong relationship between chemistry and librarianship, pointing to references to librarianship on the American Chemical Society (ACS) resource page. The strong support of the ACS Chemical Information section may be why 17% of physical science librarians in one survey maintained membership in the ACS.

A recent book on alternative careers in chemistry highlighted a changing view of the information profession. It explains that librarians now conduct far fewer searches, instead teaching users how to search on their own. Now that per-minute database charges have been eliminated, end users can search more easily, and "even more knowledge of chemistry is required to use search tools efficiently." (Balbes, 2007, p. 39) The text seems to draw a sharp contrast between the scientific librarian and the information professional. The term "librarian" is used more in conjunction with instruction and the warehousing functions, storage and retrieval of collections. By contrast, "information scientists not only locate but also interpret, summarize, manage, and organize information." (Balbes, 2007, p. 41)

Degree earned: MLS/LIS versus IS

There has been considerable debate about the essential divide or unity between library science and information science. Some schools grant a single degree in LIS, while others grant separate degrees for LS and IS. The close association of LIS and education is revealed by the WILIS results; some degrees were Educational Specialist (Ed.S.) rather than LIS-named degrees. The author used recoding (type_of_degree) already performed

by a previous WILIS researcher and performed additional coding to consolidate degree types.

There were highly statistically significant differences ($p<0.001$) in the highest LIS-related degrees received by natural scientists and others.

type_of_degree 2
Frequency

	BS	EdS/MEd	MIS	Missing	MLIS	MLS	PhD	Responses
Others	74	43	147	2	294	1922	38	2520
Scientists	0	0	22	0	22	88	1	133
-All-	74	43	169	2	316	2010	39	2653

Share of Responses

Others	0.0294	0.0171	0.0583	0.0008	0.1167	0.7627	0.0151	2520
Scientists	0.0000	0.0000	0.1654	0.0000	0.1654	0.6617	0.0075	133
-All-	0.0279	0.0162	0.0637	0.0008	0.1191	0.7576	0.0147	2653

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	32.9746	<.0001
Pearson	33.7343	<.0001

Most graduates, including most science degree-holders, pursued a traditional MLS, but fewer science graduates did so (66% of natural science graduates versus 73% among others.) Proportions for blended MLIS degrees were fairly similar (17% for natural science graduates versus 12% for others.) However, scientists were more likely to receive a pure IS degree (17% versus 6%) and slightly less likely to receive a Ph.D. (0.8% versus 1.5%). No science graduate earned an educational specialist degree. No scientist earned a bachelor's LIS degree either; these degrees were earned by older respondents prior to institution of the MLS standard and by more recent graduates of the BSIS program at UNC Chapel Hill. Overall results are suggestive but must be interpreted with caution, as not every school offered an IS degree and differences might reflect variability in student attraction to a school rather than the degree program itself.

The higher rate of IS versus LS/LIS degrees among science graduates may be reflective of a higher interest in computers among those with a science background. See the section on computer interest later in this document for further information.

A caveat about the “prior” job

When “prior” job term is used in this paper, it refers to the survey section covering aspects of the job held immediately prior to beginning LIS studies. The author of this analysis had hoped to compare “prior job” answers with corresponding questions for the first job after LIS graduation, as some indicator of experiences in the scientific workplace versus the typical LIS workplace. On examining the data, however, the number working outside of science was surprising, as was the number who had already in some way transitioned to an LIS career before seeking the degree. While some science graduates were expected to hold jobs outside of the sciences, the percentage was quite high.

In examining job titles before entering the LIS program for science graduates, it becomes clear that the decision to “leave science” (if, in fact, a respondent had ever worked in the field) was made well before LIS program entry. Only 26 of 133 (20%) were in science-related roles (researcher, technician, science teacher) immediately prior to entering the LIS program.

Some respondents sought not to “leave science” but to take it with them to a new career environment. When prompted by the open-ended question 8A (other factors motivating LIS degree), 9 of 133 (7%) mentioned science skills/background. Representative comments included “combining a science background with another discipline,” “ability to put my science background to use and not pigeon-hole myself to

specific research interests," and "Wanted to stay in my field of study, but do something different. Science without the lab work."

Overall, a third of respondents were working in libraries before entering an LIS program, as coded by another member of the WILIS team. This proportion held true equally for science graduates and others before beginning LIS graduate studies. Because such a large share of LIS program entrants might have already come to a career decision, the power of the "job before LIS" portion of the survey to uncover career change motivation is diminished.

Supporting self and family: Linked lives and shared security

Several survey items concerned some of the most basic requirements for any job: the income and other benefits that allow one to support oneself and one's family. Because the lives and fortunes of family members are "linked," relocation is discussed in this section as well. Science graduates did not show any differences in the family and security context of their career decision-making as compared with other LIS graduates.

Relocation prior to LIS program entry

The survey asked about two types of relocation: moving in general and immigrating to a new country in particular. The reasons for moving were not specified, but trailing a spouse might be one reason.

Immigrating to a new country

This was a rare reason, and there was no significant difference between science graduates and others in its importance.

Moving to a new location

Science graduates cited relocation as slightly less relevant to their decision to leave the job prior to LIS studies, but the difference did not reach statistical significance.

C14E: Moving to another location

Frequency

	Not a reason	Minor reason	Major reason	No answer or not working for pay immediately before LIS program entry	Total respondents
Others	1185	93	396	131	1805
Scientists	66	5	13	13	97
-All-	1251	98	409	144	1902

Share of Responses

Others	0.6565	0.0515	0.2194	0.0726	1805
Scientists	0.6804	0.0515	0.1340	0.1340	97
-All-	0.6577	0.0515	0.2150	0.0757	1902

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	7.4344	0.0593
Pearson	7.7902	0.0506

Family considerations

Number of children

There was no statistically significant difference in the number of children for LIS graduates who do or do not hold a science degree.

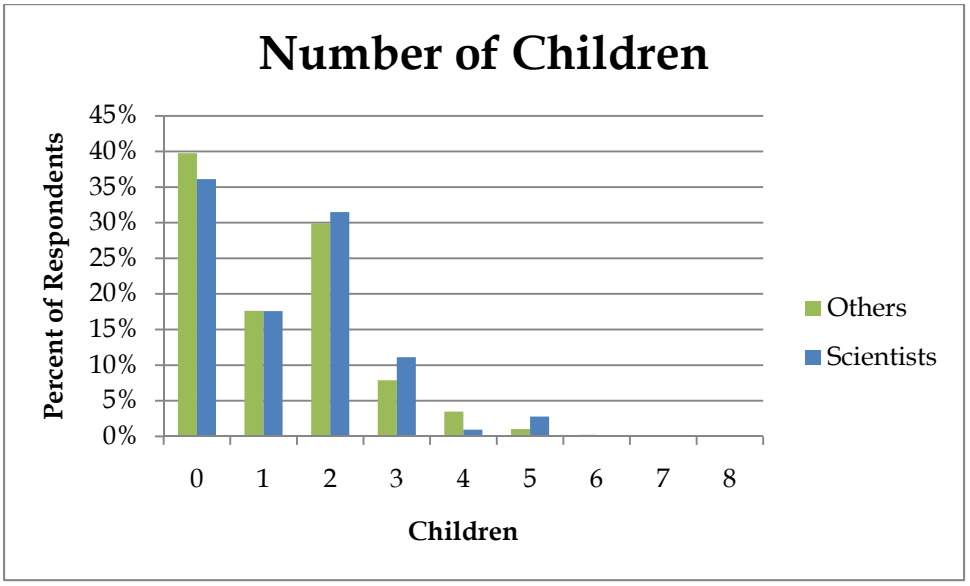

Figure 4: Number of Children

J1
Frequency

	0	1	2	3	4	5	6	7	8	Responses
Others	847	376	637	168	74	22	5	1	1	2131
Scientists	39	19	34	12	1	3	0	0	0	108
-All-	886	395	671	180	75	25	5	1	1	2239

Share of Responses

Nat-Sci/Others	0	1	2	3	4	5	6	7	8	Responses
Others	0.3975	0.1764	0.2989	0.0788	0.0347	0.0103	0.0023	0.0005	0.0005	2131
Scientists	0.3611	0.1759	0.3148	0.1111	0.0093	0.0278	0.0000	0.0000	0.0000	108
-All-	0.3957	0.1764	0.2997	0.0804	0.0335	0.0112	0.0022	0.0004	0.0004	2239

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	7.1044	0.5254
Pearson	6.9114	0.5462

Career breaks to care for children

Those who had children were asked if they had ever taken a break of more than six months to care for them. Most had not, and this proportion did not differ between LIS graduates who did and did not possess a science degree.

J2
Frequency

	Yes	No	No Answer	Not applicable	Responses
Others	444	838	2	847	2131
Scientists	24	45	0	39	108
-All-	468	883	2	886	2239

Share of Responses

Nat-Sci/Others	Yes	No	No Answer	Not applicable	Responses
Others	0.2084	0.3932	0.0009	0.3975	2131
Scientists	0.2222	0.4167	0.0000	0.3611	108
-All-	0.2090	0.3944	0.0009	0.3957	2239

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	0.7843	0.8532
Pearson	0.6823	0.8774

Career breaks to care for other family members or household responsibilities

Extremely few LIS graduates have taken career breaks for caretaking responsibilities. This was equally true for science graduates and others.

"Fits with family responsibilities" as a reason to seek LIS degree

Scientific careers, particularly in academia, have been criticized as demanding women to sacrifice family obligations. By contrast, among students with advanced degrees (albeit mostly not in science), more felt positive than negative about librarianship's support of flexibility to meet family obligations. (Kim, Chiu, Sin, & Robbins, 2007)

Analysis of the WILIS data set showed that those with science degrees were no more likely to cite family obligations as a motivator than those with degrees in other fields. While this factor is strong anecdotally, including in qualitative responses from this study, in the aggregate the data do not bear out strong importance for this factor for LIS graduates.

Consistent with traditional gender norms, however, women weighted this factor more than men ($p<0.0001$).

A7G: An LIS career fits with my family responsibilities

Frequency

A20: What is your sex?	Not at all	A little	A moderate amount	A lot	Responses
Male	287	85	66	32	470
Female	999	321	423	407	2150
.	1286	406	489	439	2620

Share of Responses

Male	0.6106	0.1809	0.1404	0.0681	470
Female	0.4647	0.1493	0.1967	0.1893	2150
.	0.4908	0.1550	0.1866	0.1676	2620

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	66.9115	<.0001
Pearson	59.6003	<.0001

Family factors as a reason to leave the job before LIS program entry

Grandy (1998) found that women who left science careers frequently cited personal or family reasons for the change; however, they were more likely to shift to health careers than to other fields such as librarianship.

In the WILIS study, there was no difference between science graduates and others in the proportion who left the “prior job” to become a parent or caregiver. In terms of the actual experience at the prior job, those with science degrees were no more likely than

others to experience difficulty taking time off from work to take care of personal or family matters.

Importance of the ability to balance work and family responsibilities

Grandy (1998) also found that science graduates who began graduate work in a non-science field valued flexible scheduling more those who continued science studies.

The importance of work/family balance as a general job factor did not differ between groups in the WILIS study.

Personal health or disability

Poor health or disability can constrain career choices whether one is living alone or supporting a family. In the WILIS study, extremely few respondents had taken career breaks due to poor health, and science graduates did not differ from others in the proportion having done so. As with poor health, short breaks in career due to disability were extremely uncommon and no less so for scientists than others.

Employment security

Overall shape of career path

When asked to characterize their overall career history, there were no significant differences in overall career advancement between those with and without a science degree. Despite the rosy vision of scientific employability, former science majors who turned to LIS took career “demotions” just as often as others. Over one-fifth of LIS graduates found themselves in such a position during their careers.

K3

Frequency

	2+ jobs, moving up	2+ jobs, moving laterally and up	2+ jobs, moving laterally only	2+ jobs, moving laterally and down	2+ jobs, moving down	3+ jobs, moving up and down	Only 1 or no job moves	Don't know
Others	635	743	158	26	6	427	73	38
Scientists	35	41	3	2	0	24	1	1
-All-	670	784	161	28	6	451	74	39

Share of Responses

Others	0.3015	0.3528	0.0750	0.0123	0.0028	0.2028	0.0347	0.0180
Scientists	0.3271	0.3832	0.0280	0.0187	0.0000	0.2243	0.0093	0.0093
-All-	0.3028	0.3543	0.0728	0.0127	0.0027	0.2038	0.0334	0.0176

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	8.7963	0.2676
Pearson	6.8252	0.4473

Career breaks due to involuntary unemployment

When asked about involuntary unemployment lasting more than 4 weeks but less than 6 months, there was no statistically meaningful difference between experiences of those with and without a science degree. Most respondents (90% of science graduates and 87% of others) had experienced no such break.

Job security-related reasons to leave the pre-LIS program entry job

Not all employment is equally stable. Several questions assessed stability in the job immediately prior to LIS program entry as a potential motivator to commence graduate studies. Self-employment, contract work, or a downsizing employer does not offer the same perception of income security as traditional employment. Relevant results point overall to somewhat greater instability of employment for science graduates immediately prior to LIS program entry, although not all differences achieved statistical significance.

Reason to leave a prior job and pursue LIS studies	Subgroup	Not a reason	Minor reason	Major reason	No answer or not working for pay immediately before LIS program entry	Total respondents
Leaving self-employment*	Others	0.9119	0.0066	0.0089	0.0726	1805
	Scientists	0.8247	0.0206	0.0206	0.1340	97
Downsizing or company closing*	Others	0.9003	0.0111	0.0166	0.0720	1805
	Scientists	0.8144	0.0309	0.0206	0.1340	97
Layoff	Others	0.9053	0.0061	0.0166	0.0720	1805
	Scientists	0.8351	0.0103	0.0206	0.1340	97
Leaving temporary/ contract work	Others	0.8493	0.0211	0.0576	0.0720	1805
	Scientists	0.7526	0.0206	0.0928	0.1340	97
Promotion within my employer	Others	0.7967	0.0327	0.0981	0.0726	1805
	Scientists	0.7216	0.0619	0.0825	0.1340	97

*Significant at $p<0.05$

Job availability/security

In the span of one's career, science graduates did not differ from others in the importance placed on job security as a general job characteristic. Job availability played an equal role as a motivator to enter an LIS program for science graduates and others.

Flexible career options

Much of the work in science is highly specialized, and mismatched specialization might in some cases constrain one's career growth. While science majors cited the need for more flexible career options somewhat more often as a motivator to pursue an LIS degree, differences did not reach statistical significance.

A7F: Flexible career options
Frequency

	Not at all	A little	A moderate amount	A lot	Responses
Others	602	571	832	506	2511
Scientists	22	31	43	37	133
-All-	624	602	875	543	2644

Share of Responses

Others	0.2397	0.2274	0.3313	0.2015	2511
Scientists	0.1654	0.2331	0.3233	0.2782	133
-All-	0.2360	0.2277	0.3309	0.2054	2644

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	6.6014	0.0857
Pearson	6.6161	0.0852

An interesting trend emerged when the "flexible career options" variable was examined by gender. Prior research has suggested than in many heterosexual dual-income households, a man's career takes priority and the woman must be more flexible in her career. (Gilbert & Kearney, 2006) For the full set of librarians, however, findings were highly significant in the opposite direction. Men more strongly cited the need to have flexible options.

A7F: Flexible career options
Frequency

A20: What is your sex?	Not at all	A little	A moderate amount	A lot	Responses
Male	78	101	177	115	471
Female	541	494	690	426	2151
.	619	595	867	541	2622

Share of Responses

Male	0.1656	0.2144	0.3758	0.2442	471
Female	0.2515	0.2297	0.3208	0.1980	2151
.	0.2361	0.2269	0.3307	0.2063	2622

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	20.8278	0.0001
Pearson	19.9922	0.0002

Salary

Salary as a reason to pursue an LIS degree

A common theme in library literature is the low salaries of graduates. Those who choose librarianship appear to be realistic about salary expectations. Slightly over a third of LIS students cited salary as a motivating factor in Moen's study. (1988) Scherdin

(From children's, 1994) found that special for-profit and government librarians were more motivated by income considerations as compared with public librarians. Not surprisingly, she also reported that desire for greater income was a predictor of dissatisfaction among the full set of librarians. Even satisfied librarians were least satisfied with income as compared with all other aspects of their current job.

In the WILIS study, about 74% stated that salary was only “a little” or “not at all” a motivating factor in the decision to pursue an LIS degree, and there was no difference between those with and without a science background.

There was a slight but statistically significant difference between men and women pursuing the LIS degree (p=0.001). Only 69% of men stated that salary was “a little” or “not at all” a factor in their career choice.

Better salary as reason to leave the job before LIS

As common legend would have it, those with a science background would have to sacrifice earnings to pursue an LIS degree. When asked about the job held just prior to LIS studies, however, statistically equivalent proportions of science graduates and others stated that they were leaving the prior job in hopes of a better salary.

	Not a reason	Minor reason	Major reason	No answer or not working for pay immediately before LIS program entry	Total respondents
Others	633	314	730	219	1896
Scientists	28	18	40	14	100
-All-	661	332	770	233	1996
Share of Responses					
Others	0.3339	0.1656	0.3850	0.1155	1896
Scientists	0.2800	0.1800	0.4000	0.1400	100
-All-	0.3312	0.1663	0.3858	0.1167	1996

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	1.5063	0.6808
Pearson	1.4938	0.6837

Importance of "good pay" as a general job characteristic

Though few pursue an LIS degree for the money, nearly everyone agrees that "good pay" is generally important as a job characteristic. Fewer than 5% thought good pay was only "a little" or "not at all" important. No difference emerged between groups.

Benefits

There is no reason to suspect that science graduates would value benefits differently, and the data confirmed a lack of difference between the groups in three separate measures: 1) benefits as a motivation to pursue LIS, 2) "importance of fringe benefits" as a general job characteristic, and 3) "better benefits" as a reason for leaving the pre-LIS degree job.

Practical considerations in transition

Once someone has determined that a new LIS career will not conflict with family responsibilities and is likely to provide financial security and peace of mind, one must still obtain the LIS degree. While factors important for choosing a particular LIS program will not be considered here, two general elements important in the transition were examined.

Length of training

Training length was not considered important by most in the decision to pursue LIS studies. While science respondents did seem to consider training length more important than others, the difference fell just shy of statistical significance.

A7A: Length of training
Frequency

	Not at all	A little	A moderate amount	A lot	Responses
Others	1200	513	575	218	2506
Scientists	47	34	38	13	132
-All-	1247	547	613	231	2638

Share of Responses

Others	0.4789	0.2047	0.2294	0.0870	2506
Scientists	0.3561	0.2576	0.2879	0.0985	132
-All-	0.4727	0.2074	0.2324	0.0876	2638

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	7.8314	0.0496
Pearson	7.7213	0.0521

Flexible education options for working adults

As with the above question, science graduates seemed slightly more inclined to consider this practical concern important, but the difference failed to reach statistical significance and could have appeared by chance.

A7B: Flexible education options for working adults
Frequency

	Not at all	A little	A moderate amount	A lot	Responses
Others	1214	286	425	584	2509
Scientists	50	21	29	33	133
-All-	1264	307	454	617	2642

Share of Responses

Others	0.4839	0.1140	0.1694	0.2328	2509
Scientists	0.3759	0.1579	0.2180	0.2481	133
-All-	0.4784	0.1162	0.1718	0.2335	2642

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	6.9361	0.0740
Pearson	7.0375	0.0707

Because flexible education options for working adults might also correlate with flexible options for those with family responsibilities, this variable was examined by gender (for the full data set, not only the science graduates). As anticipated, flexibility was far more important for women than for men, a highly statistically significant result.

A7B: Flexible education options for working adults

Frequency

A20: What is your sex?	Not at all	A little	A moderate amount	A lot	Responses
Male	217	62	105	85	469
Female	1037	241	343	529	2150
.	1254	303	448	614	2619

Share of Responses

Male	0.4627	0.1322	0.2239	0.1812	469
Female	0.4823	0.1121	0.1595	0.2460	2150
.	0.4788	0.1157	0.1711	0.2344	2619

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	17.6475	0.0005
Pearson	17.8722	0.0005

LIS as a profession: Exposure and opinions

Recommendations by others

The literature generally reports that personal recommendation may be important as a reason to pursue librarianship; however, the proportion varies between studies. In an LIS student survey conducted in the 1980s, most respondents stated that other people had little to no influence in their decision to pursue librarianship. (Heim & Moen, 1989) The initial motivator to pursue science librarianship for 13% in another study was recommendation by another person, although proportions of relations with the person making the recommendation were not specified. Some were librarians. (Eells, 2007) Recommendations were a major factor for some in other surveys: 34% (Ard, et al., 2006) in one study and 32% in another (Moen, 1988)

WILIS results show recommendations to be of modest but significant importance.

Guidance counselor in high school

High school guidance counselors were equally irrelevant for librarians with or without a science degree. More than 97% stated they were not at all a factor. Men were given such guidance as often as women.

A family member or friend in LIS

Despite a concern that science majors might not have as much library exposure, they were equally likely to state that a family member or friend working in LIS had some influence on them. Over half said this was not at all a factor.

Family member or friend recommended LIS

There were no differences between groups. Just over half of respondents stated that this was not at all a factor for them. There was no reported difference by gender.

Recruited by LIS program

The literature has lamented the poor job of marketing done by LIS programs. One pre-Web study of LIS students found that only 13% chose the field based on a program brochure. (Moen, 1988) The WILIS study shows results far below that figure. Over 90% of WILIS respondents stated that LIS recruitment mattered “not at all” in their motivation to pursue an LIS degree, despite the presence of five LIS programs in the state of North Carolina. On a positive note, marketing does not discriminate by undergraduate background. Programs were no less likely to recruit science graduates than anyone else.

Programs did appear to be making some headway in addressing gender imbalance. More men than women (p=0.04) stated they had been recruited by an LIS program.

A6i. Recruited by LIS program
Frequency

A20: What is your sex?	Not at all	A little	A moderate amount	A lot	Responses
Male	414	26	18	9	467
Female	1967	94	40	38	2139
.	2381	120	58	47	2606

Share of Responses

Male	0.8865	0.0557	0.0385	0.0193	467
Female	0.9196	0.0439	0.0187	0.0178	2139
.	0.9137	0.0460	0.0223	0.0180	2606

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	7.4423	0.0591
Pearson	8.4341	0.0378

Always wanted to be a librarian

The "always wanted" factor shows the influence of a larger group of people, essentially society's image of librarianship passed on to children. The role of stereotype in career selection is well studied. The reader is referred to Magrill (1969) and Slater (1979) for older but substantive treatments of the topic.

For the WILIS respondents, this variable shows highly significant differences between groups.

A6D: Always wanted to be a librarian
Frequency

Nat-Sci/Others	Not at all	A little	A moderate amount	A lot	Responses
0	1073	581	406	442	2502
1	81	28	16	7	132
-All-	1154	609	422	449	2634

Share of Responses

0	0.4289	0.2322	0.1623	0.1767	2502
1	0.6136	0.2121	0.1212	0.0530	132
-All-	0.4381	0.2312	0.1602	0.1705	2634

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	25.6085	<.0001
Pearson	22.5520	<.0001

Because librarianship has been a highly gendered profession, and because women who pursue science may be more likely to defy gender norms, this question was analyzed for gender differences for the full set of respondents, again with highly statistically significant results.

A6D: Always wanted to be a librarian
Frequency

A20: What is your sex?	Not at all	A little	A moderate amount	A lot	Responses
Male	287	105	46	30	468
Female	848	501	374	418	2141
.	1135	606	420	448	2609

Share of Responses

Male	0.6132	0.2244	0.0983	0.0641	468
Female	0.3961	0.2340	0.1747	0.1952	2141
.	0.4350	0.2323	0.1610	0.1717	2609

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	102.056	<.0001
Pearson	94.1731	<.0001

Importance of having a profession that is recognized and respected

In popular surveys of career prestige, scientist jobs often rank fairly high. While not specific to librarianship, those leaving science for graduate study in other fields were significantly less likely to believe their new field was “prestigious” compared to those continuing graduate study in the sciences. (Grandy, 1998)

One wonders, then, whether science graduates who turned to LIS might consider prestige less important. Survey results showed no significant difference between groups.

K2A
Frequency

	Not at all important	A little important	Somewhat important	Very important	Responses
Others	60	218	955	872	2105
Scientists	2	11	52	42	107
-All-	62	229	1007	914	2212

Share of Responses

Others	0.0285	0.1036	0.4537	0.4143	2105
Scientists	0.0187	0.1028	0.4860	0.3925	107
-All-	0.0280	0.1035	0.4552	0.4132	2212

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	0.7417	0.8634
Pearson	0.7000	0.8732

These findings are surprising given previous literature. Moen (1988) found that only one third of librarians cited status as an important reason to pursue librarianship. Students in an LIS/IS/Archives program rated librarians as roughly equal in status to social workers but less prestigious than computer professionals (computer engineering and information architecture) and doctors. (Duff, Cherry, & Singh, 2006) Scherdin (From children's, 1994) found that special librarians were less optimistic than ALA librarians about the public prestige for librarianship.

Not everyone may view the profession in a positive light. A survey of health scientists turned librarians found that 16% experienced negative reactions and 20% experienced mixed reactions from friends and family about their decision to change careers to librarianship. (Fikar & Corral, 2001)

Scherdin (From children's, 1994) found that those who chose librarianship out of a belief that people respect the profession were more likely to be satisfied. Numerous science librarians note the additional prestige/respect that science background affords them with the faculty. (Hackenberg, 2000)

LIS experience

While others can influence career choice, the best way to consider the suitability of information work seems to be to experience the work oneself. This is true for many even before applying for the LIS program.

Worked as an assistant in a library/information center

Heim and Moen (1989) found that over half of LIS students they surveyed claimed prior experience in a library was in the top two tiers of importance as a reason to pursue the career. Nearly a quarter (22%) of science librarians in Eells's (2007) study said they first became interested in science librarianship while working in a library. Two general studies of librarianship indicate that experience in a library was a strong motivator to attend library school. (Ard, et al., 2006) (Moen, 1988)

This trend was replicated in the WILIS results. More than half of all LIS graduates stated that work experience in a library was at least a little important in motivating pursuit of an LIS degree. Scientists were no less likely to cite this experience as a motivating factor than others, and men and women cited such experience in similar proportions.

A6j. Worked as an assistant in a library or information center

Frequency

	Not at all	A little	A moderate amount	A lot	Responses
Applied Sciences	49	4	9	18	80
Natural Sciences	59	9	13	51	132
Others	1094	210	299	824	2427
-All-	1202	223	321	893	2639

Share of Responses

Applied Sciences	0.6125	0.0500	0.1125	0.2250	80
Natural Sciences	0.4470	0.0682	0.0985	0.3864	132
Others	0.4508	0.0865	0.1232	0.3395	2427
-All-	0.4555	0.0845	0.1216	0.3384	2639

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	10.9744	0.0892
Pearson	10.7625	0.0960

As previously noted, about a third of respondents were working in a library immediately prior to entering an LIS program, with no difference between scientists and others in this percentage.

Library or Non-Library (Prior job)
Frequency

	Non-library	Library	66	Responses
Others	1056	690	150	1896
Scientists	55	34	11	100
-All-	1111	724	161	1996

Share of Responses

	Non-library	Library	66	Responses
Others	0.5570	0.3639	0.0791	1896
Scientists	0.5500	0.3400	0.1100	100
-All-	0.5566	0.3627	0.0807	1996

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	1.1750	0.5557
Pearson	1.2816	0.5269

Given such high percentages, it would be useful to find out how individuals gained library assistant positions. It is not unusual for students to be assigned to library work as part of work-study in a financial aid package. Clearly this is a valuable resource for library recruitment. Librarians may not recruit family members or friends to become librarians, but they seem more clearly to encourage those who work with them as students or paraprofessionals.

There was no difference between science graduates and others in whether LIS skills/knowledge applied in the prior job.

C1: Which of the following best describes this job? This job was a position...
Frequency

	In a library/ info center using LIS skills/ knowledge	In a library/ info center NOT using LIS skills/ knowledge	In a NON-library/info center using LIS skills/ knowledge	In a NON-library/ info center NOT using LIS skills/ knowledge	Self-employed	Other	N/A: Not employed immed. prior to LIS program	Responses
Others	539	147	195	690	25	150	150	1896
Scientists	25	9	9	38	2	6	11	100
-All-	564	156	204	728	27	156	161	1996

Share of Responses

Others	0.2843	0.0775	0.1028	0.3639	0.0132	0.0791	0.0791	1896
Scientists	0.2500	0.0900	0.0900	0.3800	0.0200	0.0600	0.1100	100
-All-	0.2826	0.0782	0.1022	0.3647	0.0135	0.0782	0.0807	1996

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	2.5978	0.8574
Pearson	2.6983	0.8456

Volunteered in a library/information center

Volunteerism was not a key driver toward librarianship; 69% said it was “not at all” a factor in the decision. There was no difference between natural scientists and others on this measure. In keeping with gender norms for females to be more involved in volunteerism, women were more likely ($p<0.0001$) to cite this factor than men, with 67% of women but 81% of men claiming no influence at all from volunteering.

Work environment

Most information professionals did not go straight from high school to undergraduate education to a master’s program. The decision to seek a career in LIS was made with comparison to other job options and experience; the perceived benefits offered by an LIS career presumably outweighed both the benefits of another career and investment of time and money to earn the LIS degree. The following sections will discuss findings about occupational needs/values. These values will be grouped into thematic clusters partially inspired by motivational aspects identified by Maslow (1970) and Herzberg (1968) as discussed in the introduction.

Work schedule

There are many reasons people might desire to work fewer/better hours, including family responsibilities, family leisure, and personal leisure considerations. In addition, flexibility of hours can give employees a feeling of enhanced personal control, which in turn leads to increased job satisfaction. It appears that science graduates did not differ from others with respect to suitable schedules.

Prior job: Hours and scheduling control

One former scientist who became a librarian was thrilled at the change: “I can continue research in science! I can find a great job that doesn’t run my life!” (Hallmark & Lembo, 2003)

In the WILIS study, however, fewer than half of respondents, scientists and others alike, cited a desire for better working hours as a reason to leave the job before LIS studies. On the experience of personal control over scheduling work hours and when to take breaks at the prior job, no difference emerged between groups.

Time “to get the job done”

Employees may feel pressured to work more hours if they do not feel they have sufficient time to accomplish required tasks. Such pressure could conceivably cause one to seek a less stressful workplace. While most found this factor important, no difference between groups emerged. This was true for the job prior to entering the LIS program, the current job, and the importance of “having enough time to get the job done” as a general job characteristic.

Importance of a lot of leisure time (e.g., time for hobbies)

Respondents (with and without science background) rated leisure time as only a little or somewhat important in general.

Management support

As suggested by Herzberg (1968), good management is needed to maintain a positive working environment and prevent dissatisfaction. Scherdin (From children's, 1994) found

that supervision/feedback issues formed the second-most important reason for job dissatisfaction among librarians, just behind salary.

Several WILIS survey items addressed quality of management. Whether related to general values, experience at the job prior to entering LIS studies, or the current position, science graduates did not indicate significant difference of opinion from their peers. Over 80% felt that having "good enough support and equipment to get the job done" was very important. While not judged as critical, still more than 85% felt that having clearly defined job responsibilities was somewhat or very important. When thinking about the job held prior to beginning LIS studies, the majority disagreed that they had too much work to do everything well. Respondents were roughly evenly split on whether hopes for a better working environment were a factor in leaving the "prior" job.

The final, broadest question in this category is reported even though it did not reach statistical significance (p=0.06). There was a trend toward management at the "prior" job being somewhat better for science graduates than others; more said "better quality of management" was not at all a reason to leave the prior job.

C13H: Seeking better quality of management

Frequency

	Not a reason	Minor reason	Major reason	No answer or not working for pay immediately before LIS program entry	Total respondents
Others	999	335	338	224	1896
Scientists	62	16	8	14	100
-All-	1061	351	346	238	1996

Share of Responses

Others	0.5269	0.1767	0.1783	0.1181	1896
Scientists	0.6200	0.1600	0.0800	0.1400	100
-All-	0.5316	0.1759	0.1733	0.1192	1996

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	8.5497	0.0359
Pearson	7.3717	0.0609

Personal autonomy

Autonomy is an often-cited contributor to job satisfaction. Lim (2008) found that autonomy was positively associated with job satisfaction in academic library IT workers.

When it came to measures of personal control and input in the workplace, no differences emerged between science graduates and others in the WILIS study. Over 60% felt it was very important in general that supervisors value your opinion. While the information professions are praised as social and collaborative, solo work is also valued. Nearly 90% agreed that it was somewhat or very important to have a job that allows one to work independently. In their current roles, only about 6% disagreed that "it is basically my own responsibility to decide how my job gets done."

As to experiences in the "prior" job, few in either group had strong feelings of agreement or disagreement that they had "a lot of say about what happened at my job" at the "prior" job.

Social/belongingness needs, social good, and service

While workers value autonomy, many also value the ability to work with others and to be part of a greater whole. Some have asserted that scientists (who typically approach problems in an objective fashion) are simply not suited to the "people-oriented" field of librarianship and should be passed over in the hiring process; Storm and Wei (2007) speak for such "enlightened library administrators." Do former scientists who pursue a library career really show an absence of social motivation, or is this an exaggerated stereotype against a minority?

General sociability drive

Like working with people

The social element of librarianship is often strongly stressed both in the public eye and in library schools, but not all librarianship specialties are equally likely to value this element. Technical services librarians and special librarians scored less interest in Holland's Social theme as compared to public, school, and children's librarians. (David & Scherdin, 1994) Special and academic librarians also scored lower on Strong's Public Speaking scale as compared with school and public librarians. (David & Scherdin, 1994) In a study of those with science background entering graduate school in a different field, those leaving science expressed a strong interest to work with people, but those staying in science rated working with people and things equally interesting. (Grandy, 1998)

The literature indicates that a science interest need not preclude a social interest. Nearly one in five respondents in a study of scientists who had become librarians (Hallmark & Lembo, 2003) cited the satisfaction of working on a team with faculty or researchers as a reason to pursue librarianship. Several science librarians lamented the relative lack of desired collaboration with researchers. (Hackenberg, 2000)

In a study of library students who already had advanced degrees (few in science), 6% cited the "cooperative rather than solitary and competitive environment" as one of the top two reasons to pursue academic librarianship. (Kim, Chiu, Sin, & Robbins, 2007)

In the WILIS results, a desire to work with people does seem to matter somewhat less for science graduates as a motivation to enter an LIS program, but the difference is small enough to fall just shy of statistical significance. Overall, only 11-13% of those who pursue an LIS degree state that working with people is "not at all" a motivating factor.

A6g. Like working with people

Frequency

	Not at all	A little	A moderate amount	A lot	Responses
Others	282	339	881	1005	2507
Scientists	17	26	50	39	132
-All-	299	365	931	1044	2639

Share of Responses

Others	0.1125	0.1352	0.3514	0.4009	2507
Scientists	0.1288	0.1970	0.3788	0.2955	132
-All-	0.1133	0.1383	0.3528	0.3956	2639

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	7.4622	0.0585
Pearson	7.5402	0.0565

Because this question has been so contentious, the author went a step further with analysis, classifying people not only as natural scientist/not, but by more narrow categories on a scientific spectrum. In cases of multiple degrees/majors before LIS, individuals were coded according to the "highest" category on the following list:

- Physical science (e.g., chemistry, physics)
- Math
- Life Science (e.g., biological sciences)
- Earth/environmental science
- Engineering/technology
- Computer science (including information systems/IT/GIS, business with info technology specialization)
- Health science (e.g., nursing, public health, epidemiology)
- Social science (e.g., sociology, psychology, anthropology; did not include communication or political science)
- Science education (only education in physical/life/earth science or math)
- Not science

Results for this question among the various fields are shown below.

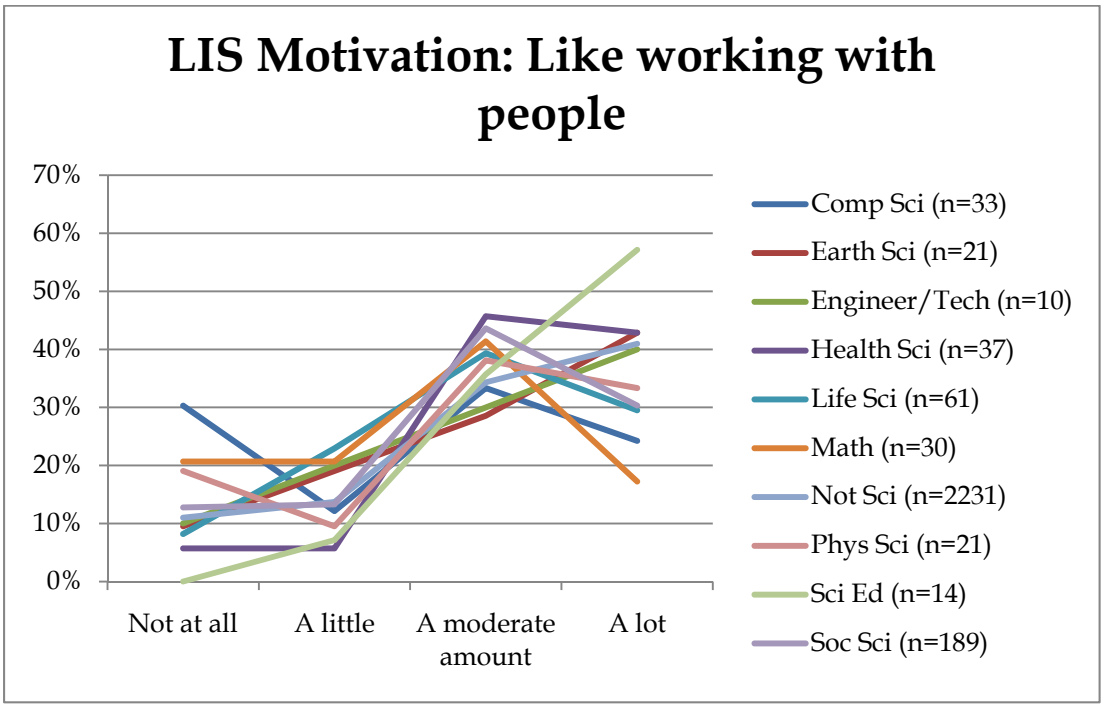

Figure 5: Motivation to work with people

The graph above shows that while there are differences based on disciplinary background, overall similarities are more striking for those who choose LIS studies. Those with computer science and math do stand out somewhat as less socially motivated, and science education and health science background a bit more so. One could still like working with people and not have considered it a reason to pursue LIS, however, so this question actually under-estimates social orientation.

As might be expected there were significant differences by gender, but even men showed strong social motivation to pursue an LIS career.

A6g. Like working with people

Frequency

A20: What is your sex?	Not at all	A little	A moderate amount	A lot	Responses
Male	87	75	164	142	468
Female	208	285	759	894	2146
.	295	360	923	1036	2614

Share of Responses

Male	0.1859	0.1603	0.3504	0.3034	468
Female	0.0969	0.1328	0.3537	0.4166	2146
.	0.1129	0.1377	0.3531	0.3963	2614

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	38.8603	<.0001
Pearson	41.4804	<.0001

Importance of a lot of contact with other people

While the previous question indicated a consistent social motivation, this does not necessarily mean information professionals need "a lot" of social contact. Direct questioning confirmed that social contact on the job was judged at least somewhat important by most LIS graduates. Graduates from the natural sciences showed somewhat less enthusiasm for this factor, but the difference did not reach statistical significance.

K2D
Frequency

	Not at all important	A little important	Somewhat important	Very important	Responses
Others	112	442	981	568	2103
Scientists	7	26	57	17	107
-All-	119	468	1038	585	2210

Share of Responses

Others	0.0533	0.2102	0.4665	0.2701	2103
Scientists	0.0654	0.2430	0.5327	0.1589	107
-All-	0.0538	0.2118	0.4697	0.2647	2210

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	7.1905	0.0661
Pearson	6.5059	0.0894

Social service

Importance of having an occupation in which one can help others

A "service orientation" was a fairly strong motivator for students even in the 1980s. (Heim & Moen, 1989) Working with people/public service was the main reason to enter librarianship for 16% of respondents in a **LIBRARY JOURNAL** poll. (Gordon & Nesbeitt, 1999) In an older study of library students, two-thirds believed a service orientation was

an important motivator. (Moen, 1988) However, the type of "help" envisioned might differ by background. Those who majored in Holland's Artistic-type majors (humanities) were statistically more likely to value "helping others who are in difficulty" in their work as compared with Investigative-type majors (sciences) (Huang & Healy, 1997)

Information professionals aim to help patrons/clients, rather than to socialize, and generally not as crowds but one-on-one or in small groups. This aspect of the profession is marked by substantial agreement by LIS graduates, regardless of undergraduate degree earned.

K2E
Frequency

	Not at all important	A little important	Somewhat important	Very important	Responses
Others	31	150	734	1191	2106
Scientists	0	7	37	63	107
-All-	31	157	771	1254	2213

Share of Responses

Others	0.0147	0.0712	0.3485	0.5655	2106
Scientists	0.0000	0.0654	0.3458	0.5888	107
-All-	0.0140	0.0709	0.3484	0.5667	2213

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	3.2205	0.3589
Pearson	1.7228	0.6319

Importance that your job is useful to society

Many LIS students in Heim and Moen's (1989) study believed service to society was important. Scherdin (From children's, 1994) found that children's public service librarians were significantly more motivated to "make an important contribution" as compared with technical services librarians. Scherdin also found that those who engaged in librarianship believing they could make an important contribution were more likely to be satisfied.

Those in different roles and different environments may disagree on the relative importance of serving society, however. In a study of LIS and IS students, more than twice as many LIS students as IS students aspired to become a major donor to charity. (Duff, Cherry, & Singh, 2006) On the Social Service scale in David and Scherdin's (1994) administration of the Strong interest inventory, academic librarians scored significantly lower than public and school librarians. Grandy (1998) found that former scientists who were entering graduate school for a different field were more likely to be engaged in community service and valued "making a contribution to society" more than those who continued in science.

The WILIS data showed no significant difference between those with and without a science major.

K2H
Frequency

	Not at all important	A little important	Somewhat important	Very important	Responses
Others	13	151	740	1201	2105
Scientists	1	5	44	57	107
-All-	14	156	784	1258	2212

Share of Responses

Others	0.0062	0.0717	0.3515	0.5705	2105
Scientists	0.0093	0.0467	0.4112	0.5327	107
-All-	0.0063	0.0705	0.3544	0.5687	2212

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	2.3980	0.4940
Pearson	2.3437	0.5042

Social support received

Some models of career change speculate that a lack of "fit" in one career might lead a person to take a new direction. Measures of social support/belonging in the "prior" job might indicate a potential reason for career change. Lim (2008) found that library IT workers who felt a sense of belonging were more likely to be satisfied in their jobs. As

mentioned previously, however, the usefulness of this question in contrasting a scientific workplace is limited, since many had already "left science" before taking the "prior" job.

Prior job: I felt I was really a part of the group of people I worked with.

There was a trend toward differences in this variable. Although it did not meet the standard criterion for statistical significance (at p=.0585), there was a trend contrary to the expected direction. Science majors felt belongingness MORE than others in the prior job, not less.

C12A: I felt I was really a part of the group of people I worked with.

Frequency

	Strongly disagree	Disagree	Agree	Strongly agree	Usually worked alone	No answer or not working for pay immediately before LIS program entry	Responses
Others	87	174	716	674	64	181	1896
Scientists	2	9	25	49	4	11	100
-All-	89	183	741	723	68	192	1996

Share of Responses

Others	0.0459	0.0918	0.3776	0.3555	0.0338	0.0955	1896
Scientists	0.0200	0.0900	0.2500	0.4900	0.0400	0.1100	100
-All-	0.0446	0.0917	0.3712	0.3622	0.0341	0.0962	1996

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	11.0683	0.0500
Pearson	10.6616	0.0585

Prior job: I had the support from coworkers that I needed to do a good job.

As with above, there was a trend, although statistically insignificant, toward the science graduates having more rather than less social support on the prior job.

C12B: I had the support from coworkers that I needed to do a good job.
Frequency

	Strongly disagree	Disagree	Agree	Strongly agree	Usually worked alone	No answer or not working for pay immediately before LIS program entry	Responses
Others	74	153	800	637	51	181	1896
Scientists	3	6	31	45	4	11	100
-All-	77	159	831	682	55	192	1996

Share of Responses

Others	0.0390	0.0807	0.4219	0.3360	0.0269	0.0955	1896
Scientists	0.0300	0.0600	0.3100	0.4500	0.0400	0.1100	100
-All-	0.0386	0.0797	0.4163	0.3417	0.0276	0.0962	1996

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	7.9213	0.1606
Pearson	7.9857	0.1570

Personal accomplishment/growth/advancement

Wanted a job where I could make a difference

Although this question did not identify what making a difference meant, it is possible that order effects could have lent the question a social connotation. The item occurred directly after “like working with people” as a motivation. At any rate, no significant difference emerged between natural scientists and others for this variable.

A6h. Wanted a job where I could make a difference
Frequency

Larger Sci Groups	Not at all	A little	A moderate amount	A lot	Responses
Applied Sci	8	15	30	27	80
Natural Sci	18	19	52	44	133
Not Sci	287	424	757	958	2426
-All-	313	458	839	1029	2639

Share of Responses

Applied Sci	0.1000	0.1875	0.3750	0.3375	80
Natural Sci	0.1353	0.1429	0.3910	0.3308	133
Not Sci	0.1183	0.1748	0.3120	0.3949	2426
-All-	0.1186	0.1736	0.3179	0.3899	2639

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	6.5456	0.3649
Pearson	6.6072	0.3587

Some similarities with the "working with people" factor also emerged when more specialized degree clusters were examined. Math and computer science backgrounds were less conducive to wanting to "make a difference," while science education was more so.

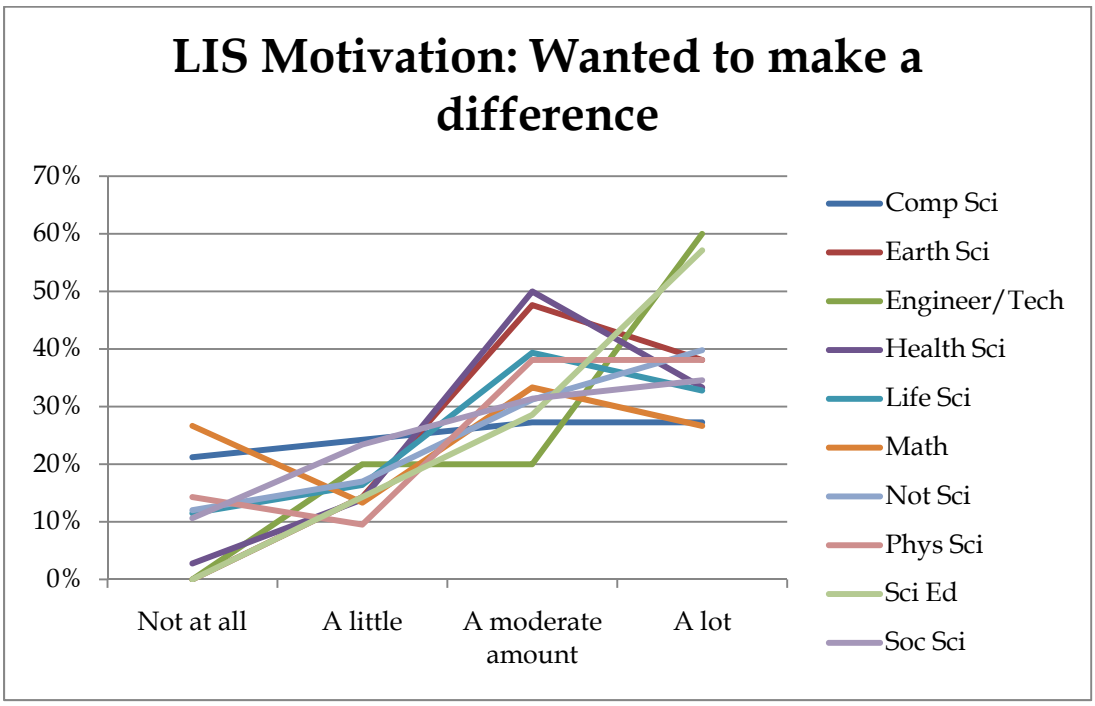

Figure 6: Making a difference

This item was also highly gendered ($p<0.0001$). Men were much less likely to value this factor than women, although only 17% of men and 10% of women felt it did not matter at all.

A6h. Wanted a job where I could make a difference
Frequency

A20: What is your sex?	Not at all	A little	A moderate amount	A lot	Responses
Male	81	97	153	138	469
Female	227	356	682	880	2145
.	308	453	835	1018	2614

Share of Responses

Male	0.1727	0.2068	0.3262	0.2942	469
Female	0.1058	0.1660	0.3179	0.4103	2145
.	0.1178	0.1733	0.3194	0.3894	2614

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	31.0786	<.0001
Pearson	31.6998	<.0001

Contribution/accomplishment in current job

Science graduates in the WILIS study did not express any difference from others in the opportunity for creative input and innovation in the current job; well above 90% agreed they had this opportunity. Two-thirds also disagreed that choices on the job required “little thought” regardless of background. The career is perceived to be an intellectual one.

A survey of library students in the 1980s indicated that intellectual opportunity was overwhelmingly the most important factor important to choosing library work. Access to the world’s knowledge also fell in the top two tiers (of a five-point scale) of importance for 67% of LIS students in that study. (Heim & Moen, 1989)

Leadership

In the WILIS study, science graduates did not consider opportunities to lead any more or less important than others did as a general job factor; about two-thirds considered this at least somewhat important. They also did not differ in how they judged the actual opportunities to develop leadership skills available at the current job; the vast majority felt such opportunities were available.

Career development/advancement

In the current study, science graduates did not differ from others in how they saw this factor as an important job characteristic. About a third thought this factor was very important, but only about 4% said it was not at all important.

Previous research has emphasized the importance of this factor. Scherdin (From children's, 1994) found that a lack of opportunities for advancement and promotion was the third-most important reason for dissatisfaction in the current job for librarians, just behind salary and supervision/feedback. Lim (2008) confirmed that promotion opportunities were important for a sample of academic library IT workers. One study that compared LIS students with IS students found that IS students were twice as likely to state career advancement as a reason to pursue their degrees. (Duff, Cherry, & Singh, 2006) Library students with other advanced degrees overwhelmingly expect their opportunities for career advancement in academic libraries to be positive. (Kim, Chiu, Sin, & Robbins, 2007) Yet advancement has also shown to be an important motivator for fewer than half of LIS students in Moen's (1988) study.

Science majors who do not go on to graduate school can sometimes find themselves stuck in lab positions that are less than stimulating, with little hope for advancement. In one longitudinal study of those five years after earning the bachelor's degree, science graduates were the least satisfied with promotion opportunities; the difference between biology majors and the overall average (including humanities majors) was statistically significant. (Horn & Zahn, 2001) However, science graduates who went on to study non-science fields in graduate school were significantly less likely to value opportunities for advancement versus those who continued in science. (Grandy, 1998)

Perhaps indicative of gender-biased opportunities, one study found that women most committed to career growth were also most likely to leave science-related careers for other fields (Farmer, Wardrop, Anderson, & Risinger, 1995); another study of female science majors found that higher career aspirations were found in women with greater self-efficacy and less perceived role conflict. (Nauta, Epperson, & Kahn, 1998) Intriguingly, in the latter study ability and role-model influence more strongly impacted self-efficacy for women studying the male-dominated physical sciences as compared with the more gender-equal biological sciences. (Nauta, Epperson, & Kahn, 1998)

Career development: "prior" job

When asked about the reasons for leaving the job before LIS studies, WILIS respondents seemed to have considered the broader concept of growth more important. About 60% of respondents (science and non) cited a desire for better career development or growth as a major reason to leave that job. With respect to promotion within that employer, a suggestive but non-statistically significant trend emerged. Science graduates were actually more likely to state that leaving the prior job to pursue the LIS degree would yield to an internal promotion. While the number of individuals is small, it is not negligible, particularly when one considers that about a third of science majors were working in a library prior to seeking the degree.

C14J: Promotion within my employer
Frequency

	Not a reason	Minor reason	Major reason	Not applicable/ not working	Responses
Others	1438	59	177	131	1805
Scientists	70	6	8	13	97
-All-	1508	65	185	144	1902

Share of Responses

Others	0.7967	0.0327	0.0981	0.0726	1805
Scientists	0.7216	0.0619	0.0825	0.1340	97
-All-	0.7928	0.0342	0.0973	0.0757	1902

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	6.5565	0.0875
Pearson	7.7656	0.0511

Career development: current job

There was no difference between those with and without a science background in the current study in terms of perceived growth opportunities in the current position. About two-thirds felt confident that the employer gave opportunities to develop and apply skills needed to advance one's career. Background also did not affect the perceived opportunities for promotion, although one in three who answered this question believed no personal opportunity existed.

Intrinsic rewards: applying skills/interests

Seemed like a good fit for my interests

Contrary to the notion of librarianship as a "fall-back" career for those who can't find work elsewhere, the work itself is perceived to be attractive to those who seek an LIS degree. Hallmark and Lembo (2003) found that 56% of scientists-turned-librarians were motivated by the love of scientific literature and the enjoyment of research itself. Many cited the variety of work from day to day and the thrill of finding the "needle in the haystack." The most frequently-selected initial motivator (25%) to pursue science librarianship in another study was appreciation for the experience as a library user doing research as a scientist or graduate student. This was a more frequent initial motivator than

experience working in a library (22%). (Eells, 2007) Fully 69% of relatively new academic science librarians (hired between 2003 and 2005) in one survey stated that it had been important for them to work in a science-related area. (Beck & Callison, 2007)

WILIS results showed no difference between natural science graduates and others on the fit of librarianships with interests. Over 60% agreed that fit with interests had "a lot" to do with the decision to enter an LIS program, and fewer than 10% felt interest mattered only a little or not at all. Those who were motivated to pursue LIS studies by a fit with their interests were significantly less likely to have left the LIS field ($p=0.0021$).

The gendered perception of librarianship might have been expected to lead to differences in this variable between men and women, and these did in fact emerge ($p=0.0002$). Still, only 6% of men and 3% of women felt fit with interest was not at all a factor.

Importance that the job is interesting

Science graduates and others agreed overwhelmingly on this factor; more than 80% found it "very important" to have interesting work. One has to wonder about the 2 of 2214 who found interesting work not at all important.

Prior job: More challenging or interesting projects

Grandy's (1998) study found that those who left science/engineering (S/E) had been less likely to find the work rewarding as compared with those who continued graduate study in the sciences. "Those leaving S/E often felt that their work did not utilize their skills, and they showed greater frustration with their work by indicating more often that they experienced obstacles to creativity. We may argue that this profile describes people

who are working at jobs below their level of capability, a situation that is likely to occur with scientists who hold only a bachelor's degree." (Grandy, 1998, p. 38) In a study of LIS students with advanced degrees in other fields, the top factor attracting them to librarianship was "intellectually rich environment" (one of top two reasons for 24%). (Kim, Chiu, Sin, & Robbins, 2007) Numerous science librarians expressed pleasure that they were able to put their former science background to good use. (Hackenberg, 2000)

In another study of reasons to pursue library work cited by LIS students, "access to world's knowledge" was important for 67%, second only to "personal skills to be used" (80%). Intellectual opportunities (85% important) were more critical than a service orientation (66%). (Moen, 1988)

In the WILIS study, a large proportion of respondents left the "prior" job in search of greater mental stimulation. However, scientists were no more or less likely than others to cite this as a reason to leave the job before the LIS degree.

Technology

Prior job: Opportunity to use leading edge technology

LIS incorporates a good bit of technology, but scientists are often exposed to advanced instrumentation in the workplace. As discussed above, however, few science majors were working in the lab prior to beginning LIS work. In the WILIS study, scientists did not differ from others in how often they left the job prior to LIS in hopes of working with the newest technology. Those who counted this a factor (major or minor) were outnumbered by those for whom it was irrelevant.

Like working with computers

While "leading edge" technology is not critical to many LIS professionals, computers are integral to most workplaces and it is helpful to find them interesting. Technology has significant history as a motivator to pursue LIS, even before the Internet explosion. Three-quarters of LIS students in one 1980s survey rated the "technological" aspect of LIS in the top two categories describing characteristics of library work. (Heim & Moen, 1989)

Those with a degree in an applied science such as computer science, health care, or engineering routinely incorporate computers into their work. The natural sciences use computers to a lesser degree, but more than those in fields such as liberal arts or education. As a result, computer interest as a motivation to pursue LIS was examined for three groups in the WILIS study: applied sciences, natural sciences, and others. Highly significant differences ($p<0.0001$) were found in the expected direction.

A6f. Like working with computers

Frequency

Larger Sci Groups	Not at all	A little	A moderate amount	A lot	Responses
Applied Sci	12	14	23	30	79
Natural Sci	48	27	27	30	132
Not Sci	1111	470	501	309	2391
-All-	1171	511	551	369	2602

Share of Responses

Applied Sci	0.1519	0.1772	0.2911	0.3797	79
Natural Sci	0.3636	0.2045	0.2045	0.2273	132
Not Sci	0.4647	0.1966	0.2095	0.1292	2391
-All-	0.4500	0.1964	0.2118	0.1418	2602

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	56.8897	<.0001
Pearson	62.5632	<.0001

Computer interest and LS/IS

Until recently, the LS degree focused more on human-intermediated information services, such as reference, while IS focused on computer-mediated services, such as information retrieval. Trends such as digital libraries and contextual design blur these boundaries, but some distinctions still exist and certainly did for much of the career of graduates surveyed. Thus, interest in computers may at least partially explain the higher proportion of scientists who pursued an IS or blended LIS versus purely LS degree. When only the subgroup of natural science graduates is considered, those most motivated by an interest in computers were significantly more ($p<0.0001$) likely to pursue IS/MLIS degrees as opposed to MLS/MSLS degrees. Recall, however, that most earned the traditional MLS.

A6f. Like working with computers (natural science subset)

Frequency

Degree Category (MLS,MIS, MLIS, PhD)	Not at all	A little	A moderate amount	A lot	Responses
MIS	1	1	4	16	22
MLIS	4	7	6	6	23
MLS	41	19	16	8	84
PhD	2	0	1	0	3
-All-	48	27	27	30	132

Share of Responses

MIS	0.0455	0.0455	0.1818	0.7273	22
MLIS	0.1739	0.3043	0.2609	0.2609	23
MLS	0.4881	0.2262	0.1905	0.0952	84
PhD	0.6667	0.0000	0.3333	0.0000	3
-All-	0.3636	0.2045	0.2045	0.2273	132

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	48.5113	<.0001
Pearson	49.5619	<.0001

Computers are calculating machines. The natural sciences may be thought to divide into quantitative sciences (e.g., math and physical science) and qualitative sciences (earth/environmental and life sciences). Those with a quantitative background were more likely to cite an interest in computers as a strong motivating factor toward LIS ($p=0.01$).

A6f. Like working with computers (natural science only)
Frequency

	Not at all	A little	A moderate amount	A lot	Responses
Qualitative	28	24	14	16	82
Quantitative	20	3	13	14	50
-All-	48	27	27	30	132

Share of Responses

Qualitative	0.3415	0.2927	0.1707	0.1951	82
Quantitative	0.4000	0.0600	0.2600	0.2800	50
-All-	0.3636	0.2045	0.2045	0.2273	132

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	12.2677	0.0065
Pearson	10.7088	0.0134

Gender is also a factor. For the full set of respondents, men were significantly ($p<0.0001$) more likely to have been motivated by computer interest to pursue an LIS degree. This mattered "a lot" to 22% of men but only 12% of women.

Professional identity and job responsibilities

Job after LIS program: Librarian or information professional?

Despite differences in the LIS degree sought, those with and without science degrees did not differ significantly in how they defined the job held immediately after LIS graduation. "Librarian" alone dominated the responses.

D2A: When you held this job, did you consider yourself to be...
Frequency

	Librarian	Information pro.	Neither a librarian or info pro.	Both a librarian and an info pro	No answer/ not asked due to skip pattern	Total
Others	819	154	105	289	1070	2437
Scientists	35	14	9	18	51	127
-All-	854	168	114	307	1121	2564

Share of Responses

Others	0.3361	0.0632	0.0431	0.1186	0.4390	2437
Scientists	0.2756	0.1102	0.0709	0.1417	0.4016	127
-All-	0.3331	0.0655	0.0445	0.1197	0.4372	2564

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	7.7362	0.1714
Pearson	8.6210	0.1252

Current identity: Librarian or information professional?

Over the career, however, former science majors appeared to drift toward statistically significant differences in perceived role (p=0.01). The identity of "librarian" alone remained the most frequent for both groups.

B23A: Do you currently consider yourself to be:
Frequency

	Librarian	Information pro.	Neither a librarian or info pro.	Both a librarian and an info pro	Responses
Others	953	331	316	819	2419
Scientists	44	30	13	38	125
-All-	997	361	329	857	2544

Share of Responses

Others	0.3940	0.1368	0.1306	0.3386	2419
Scientists	0.3520	0.2400	0.1040	0.3040	125
-All-	0.3919	0.1419	0.1293	0.3369	2544

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	9.1332	0.0276
Pearson	10.5225	0.0146

To facilitate comparisons due to differences in skip pattern, the post-LIS proportions were normalized to add to 100%. Then, approximate changes were identified as shown below.

		Librarian	Information pro.	Neither a librarian or info pro.	Both a librarian and an info pro
Others	Current	0.3940	0.1368	0.1306	0.3386
	Post-LIS	0.5991	0.1127	0.0768	0.2114
	Change	*-0.2051*	*0.0241*	*0.0538*	*0.1272*
Scientists	Current	0.3520	0.2400	0.1040	0.3040
	Post-LIS	0.4606	0.1842	0.1185	0.2368
	Change	*-0.1086*	*0.0558*	*-0.0145*	*0.0672*

For the current job, "pure" librarianship remained the dominant self-identification for those with and without a science background despite a decline. Those with a science background continued to trend toward identity as an information professional. It should be noted that "information professionals" work not only in IT and systems roles but also

in research roles outside of information centers, such as in competitive intelligence, market research, patent analysis, and the like.

Current identity: Relationship with computer interest

Since the role of "information professional" is traditionally allied more closely with technology, this concept was explored for the full WILIS set (scientists and all others). The relationship of current identity as a librarian or information professional was correlated with the importance of "like working with computers" as a reason to pursue an LIS degree. These differences were highly significant.

B23A: Do you currently consider yourself to be:

Frequency

A6f. Like working with computers	Librarian	Info Pro	Neither	Both	Responses
Not at all (a reason)	538	98	191	316	1143
A little	210	47	41	194	492
A moderate amount	165	81	49	223	518
A lot (major reason)	69	129	39	106	343
.	982	355	320	839	2496

Share of Responses

A6f. Like working with computers	Librarian	Info Pro	Neither	Both	Responses
Not at all (a reason)	0.4707	0.0857	0.1671	0.2765	1143
A little	0.4268	0.0955	0.0833	0.3943	492
A moderate amount	0.3185	0.1564	0.0946	0.4305	518
A lot (major reason)	0.2012	0.3761	0.1137	0.3090	343
.	0.3934	0.1422	0.1282	0.3361	2496

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	252.213	<.0001
Pearson	282.042	<.0001

Current identity: Relationship with social interest

A similar comparison was run for the full set with the motivation "like working with people" compared to identity as a librarian or information professional. Here again, highly significant differences arose ($p<0.0001$). Those self-identifying solely as librarians were evenly balanced in their desire or lack thereof to work with people, while those who

identified solely as information professionals were inclined against it. Those who considered themselves to fit both roles were the most motivated to work with people.

B23A: Do you currently consider yourself to be:
Frequency

A6g. Like working with people	Librarian	Info Pro	Neither	Both	Responses
Not at all (a reason)	104	53	47	76	280
A little	142	73	49	90	354
A moderate amount	368	110	131	285	894
A lot (major reason)	375	124	102	403	1004
.	989	360	329	854	2532

Share of Responses

Not at all (a reason)	0.3714	0.1893	0.1679	0.2714	280
A little	0.4011	0.2062	0.1384	0.2542	354
A moderate amount	0.4116	0.1230	0.1465	0.3188	894
A lot (major reason)	0.3735	0.1235	0.1016	0.4014	1004
.	0.3906	0.1422	0.1299	0.3373	2532

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	55.8098	<.0001
Pearson	56.8490	<.0001

Current job responsibilities

Despite differences in computer interest and identity, and time in the career to drift to preferred roles, science graduates and others did not have any statistically significant differences in five broad areas of responsibility in their current jobs. These five areas were:

- Administration
- Access and collections
- Information services, education and research
- Digital information technology and web access
- Information technology and consulting

Science graduates were potentially under-represented in administration: 30% versus 39% of others, a statistically insignificant difference (p=0.06). Despite significantly higher interest in computers by scientists, they are no more likely than others to hold

general responsibilities in digital IT or web access (p=0.74), or IT and consulting (p=0.77).

Respondents who claimed responsibilities in each of the five broad areas identified above were offered additional questions about up to 67 specific tasks. Those who did not affirm responsibility in a broad area were not offered corresponding task area questions. Because there are so many areas (multiple comparisons), we might be particularly cautious about results near the 0.05 significance level and hold a slightly more stringent standard for significance. Because of the question skip pattern, however, calculation of the Bonferonni adjustment for multiple comparisons is rendered complex and was not attempted. Only three comparisons merited further examination by falling below p=0.05.

Under the category of information services, education, and research, there was one highly significant difference (p=0.0003). While 23% of science graduates (259 respondents) claimed responsibilities in academic research and publications, only 11% of others (1079 respondents) claimed such activities. In the 1980s LIS student survey, the opportunity “to do research with and for others” was only of moderate importance compared to other factors, with just over half listing it in the top two tiers of importance. (Heim & Moen, 1989) Perhaps for science graduates the drive for research and analysis is particularly strong, and they might seek roles where they can perform this intellectual work.

Differences in background and personality do affect the choice of research topics and methodology selected by LIS researchers. (Adams & Rice-Lively, 2009) Becher (1994) notes that in terms of pedagogy, one finds the social construction of meaning in seminar form for the humanities but the positivistic replication of the laboratory in the sciences;

LIS professionals may naturally carry research values from their undergraduate experiences to their LIS research. The library literature has already exposed significant conflict regarding the relative merits (or lack thereof) of scientific methods in social research. (Sandstrom & Sandstrom, 1999; Chu, 2003) LIS research is becoming more quantitatively nuanced, incorporating inferential statistics far more frequently than in the past and demanding greater knowledge of scientific methodology and statistical analysis. (Hider & Pymm, 2008; Dilevko, 2007) By bringing diverse backgrounds with different strengths to the table, the field might reap the benefits of experience in mixed methods of research.

Two other areas of note were computer-related. Database development showed a significant difference ($p=0.03$). Slightly more science graduates (14% versus 8%) claimed this responsibility. Note that database administration and data management did not show a difference between groups. Finally, 4% of science graduates but only 1% of others listed responsibilities in the diverse category of “other” IT and consulting ($p=0.01$).

Job setting

Some of the most striking differences between those with and without a science degree come in the area of work setting, both the preferred work setting at the time of graduation and the current work setting. Information professionals can work in many different types of libraries and information centers, or even outside of them.

The general public image of a library comes from experience with a school or public library. Perhaps libraries in institutes of higher education come to mind next. Special libraries, however, operate below the radar in many senses, with a different sense of

purpose. In the public eye, the prototypical library is a place to give equal opportunity to nourish the young or the citizenry, an academic library blends educational and research goals, but few outside of LIS may recall such places as government agencies or corporations as having libraries at all.

Special libraries (including specialized branches or subject liaisons within other library types) demand a depth of subject-specific or source-specific (e.g. government document, geographic information systems[GIS]) expertise not quite as critical (although by no means irrelevant) in a general library. Special librarians are called upon to serve the few well, rather than all equally. They are called upon by their clientele to be experts in the tricks of searching subject-specific sources and even to exercise their judgment to conduct summarization or analysis of the results of a query. This is far different from the call of many other librarians to be neutral retrieval agents.

One might expect science graduates to want to make use of their technical knowledge and analytical ability in the career outside the laboratory, and qualitative responses indicated this was in fact true for quite a few. The value of technical expertise might be greater when serving specialized clientele than the general public, and so we might expect scientists to be drawn to serve in special libraries.

Setting has long been an important consideration for information professionals. In the 1980s student survey, type of work and type of library or information environment were the least likely factors to be cited as “not important” when selecting the first position. (Heim & Moen, 1989)

One researcher noted that “Applicants considering equal offers from both academic and special libraries frequently choose the latter because of the expectation of job

gratification, prestige and recognition of one's value to the research effort." (Stuart & Drake, 1992) Respondents working in for-profit companies in one study of scientists-turned-librarians (Hallmark & Lembo, 2003) volunteered that they were valued for their contributions to the company's bottom line. Corporate professionals are less likely to be known as librarians; in a survey of physical science librarians, most of the industrial practitioners had titles referencing knowledge or information rather than librarianship. (Ortega & Brown, 2005)

Scientists might differ from others in the prestige assessed academic libraries as places of work. A study of LIS students who already possessed advanced degrees (only 8% in science) found that academic libraries were overwhelmingly preferred to special libraries by these potential subject specialists. (Kim, Chiu, Sin, & Robbins, 2007) However, the same study found that 34% viewed the status of librarians as negative, versus 31% positive.

Preferred setting on program entry

Differences in preferred setting upon entering the LIS program are highly significant ($p<0.0001$).

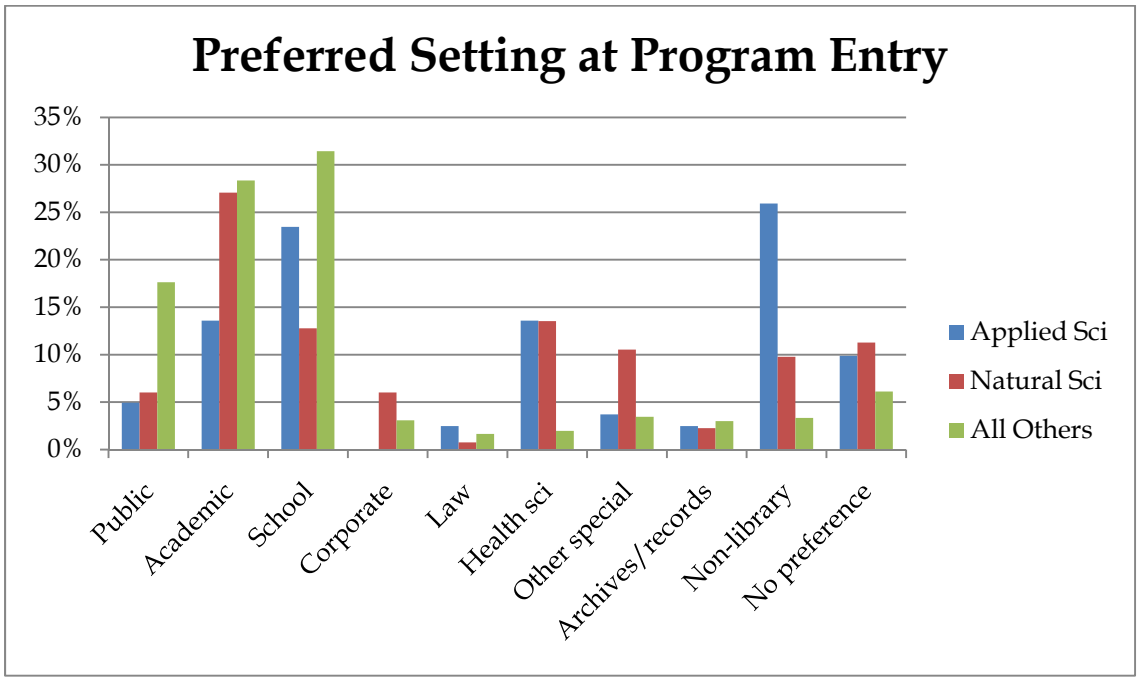

Figure 7: Preferred setting at LIS program entry

	Applied Science (n=81)	Natural Science (n=133)	All Others (n=2434)
Public	5%	6%	18%
Academic	14%	27%	28%
School	23%	13%	31%
Corporate	0%	6%	3%
Law	2%	1%	2%
Health science	14%	14%	2%
Other special	4%	11%	3%
Archives/records	2%	2%	3%
Non-library	26%	10%	3%
No preference	10%	11%	6%

A9: What was your preferred type of workplace when you entered the program?

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	181.104	<.0001
Pearson	261.984	<.0001

Because there were such striking differences in this variable, results were calculated for the more specific academic major categories. All types of special libraries have been combined in the graph below for visual clarity.

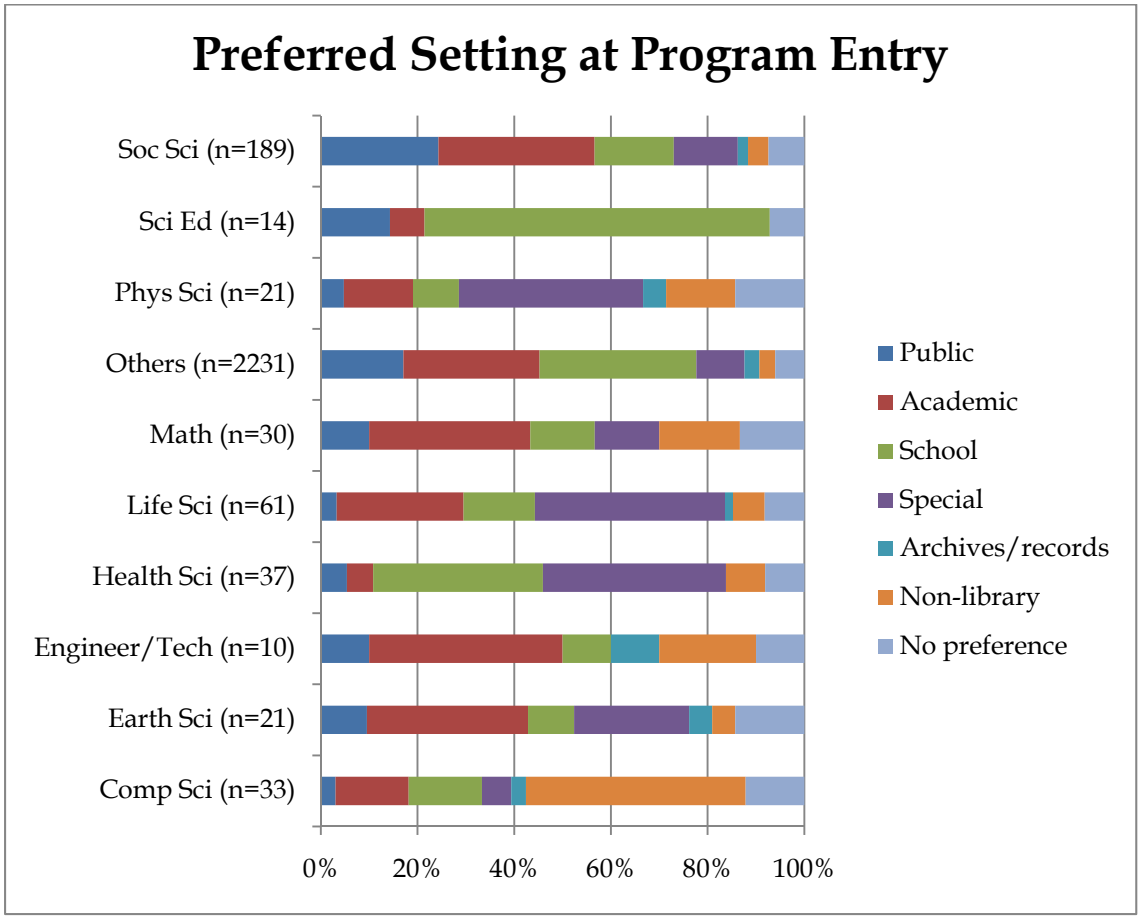

Figure 8: Initial preferred setting by major

A more detailed breakdown, including separation of percentages for special library types, is given below.

A9: What was your preferred type of workplace when you entered the program?	Comp Sci (n=33)	Earth Sci (n=21)	Enginr/ Tech (n=10)	Health Sci (n=37)	Life Sci (n=61)	Math (n=30)	Others (n= 2231)	Phys Sci (n=21)	Sci Ed (n=14)	Soc Sci (n=189)
Public	3%	10%	10%	5%	3%	10%	17%	5%	14%	24%
Academic	15%	33%	40%	5%	26%	33%	28%	14%	7%	32%
School	15%	10%	10%	35%	15%	13%	32%	10%	71%	16%
Corporate	0%	0%	0%	0%	8%	0%	3%	14%	0%	5%
Law	3%	0%	0%	3%	0%	3%	2%	0%	0%	1%
Health sci	3%	5%	0%	27%	20%	3%	2%	19%	0%	5%
Other special	0%	19%	0%	8%	11%	7%	4%	5%	0%	2%
Archives/ records	3%	5%	10%	0%	2%	0%	3%	5%	0%	2%
Non-library	45%	5%	20%	8%	7%	17%	3%	14%	0%	4%
No preference	12%	14%	10%	8%	8%	13%	6%	14%	7%	7%

Both pure and applied science graduates were far less interested in working in public libraries when entering the LIS program versus those with a background in social science or other fields. Though school libraries offer many jobs, all types of scientists except those from health science were also much less likely to want to work in that setting.

Scientists and non-scientists as general groups were equally interested in the academic setting, but interest did vary somewhat by specific discipline. Interest in working in archives was similar between groups when small sample size is taken into account for engineering.

Pure and applied scientists were particularly driven to special libraries of various types. Corporate libraries were most appealing to twice as many (by percentage) natural science graduates as others. Law libraries, however, bucked the special library trend and drew more non-scientists than natural scientists. Only 2% of nonscientists considered health science libraries preferable, while the corresponding figure for scientists was 14%!

Natural scientists showed higher level of interest for “other” special libraries, with 10% aiming for this setting, versus 3-4% for others.

There were also strong differences between groups for work outside of libraries. While 45% of computer science majors preferred to work outside of libraries, the figures were far lower for other groups. As a general rule, those with pure or applied science background were more likely to prefer this option than others.

Preferred setting: Gender differences

While scientists and non-scientists do not differ in gender ratio, the data for the overall sample seems to indicate that perceived feminization of certain settings may be stronger than others ($p<0.0001$).

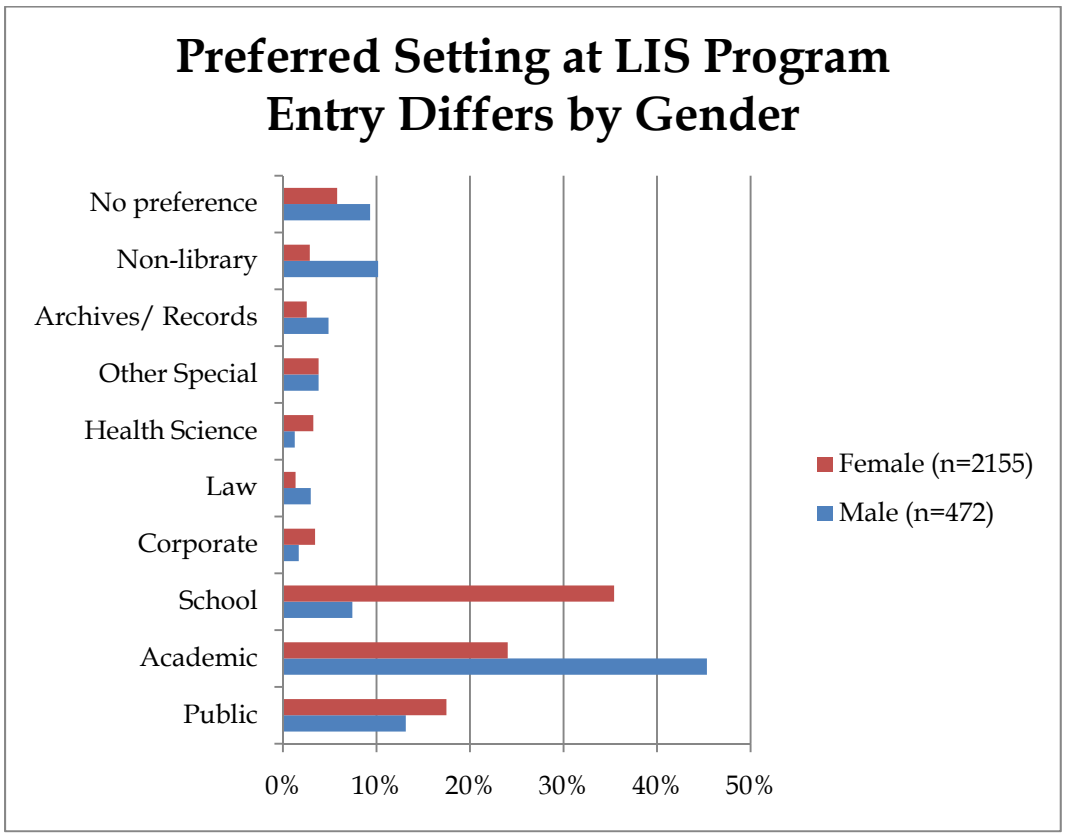

Figure 9: Initial Preferred Setting by Gender

Men showed a strong preference for working in an academic setting. By contrast, women's preferences were more diverse. Females were five times more interested in working in a school setting than males, and males five times more likely to prefer a non-library setting than females.

Interest in job setting: recent graduates only

Recent graduates (2000 or later) received a special section that others were not offered. In that section, they were asked not for their single preferred job setting (mutually exclusive) but interest or lack thereof in 7 specializations which reflect job setting. Despite reduced statistical power due to lower sample size in this sub-set, there were still statistically significant differences in job setting interest. Recent graduates with pure science degrees showed more interest in academic (p=0.04) and special libraries (p=0.002) and "other" settings (p=0.002), and less in school libraries (p=0.02).

P5: Which of the following specializations were of interest to you?	Natural Scientists (n=20)	Others (n=384)
Academic libraries*	10%	7%
Public libraries	4%	5%
School libraries*	3%	7%
Special libraries†	8%	4%
Archives	2%	3%
Information technology	4%	3%
Other†	2%	0%

*p<0.05, †p<0.01

First job following LIS graduation

Following graduation, the realities of the job market tempered some differences in job setting for the groups, but they still remained quite significant (p=0.002). Scientists were less likely than others to work in public libraries, law libraries, or "other special

libraries." They were more likely to work in health/medical libraries, corporate libraries, and "other" settings. The remaining categories were similar between groups.

D1a. Which of the following best describes the type of library or information center you worked in:

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	26.0821	0.0036
Pearson	28.1173	0.0017

D1a. Which of the following best describes the type of library or information center you worked in:	Others (n=1179)	Natural Scientists (n=60)
School library/media center	16%	7%
Public libraries	27%	22%
College/university library	31%	30%
Community college/technical Institute library	4%	3%
Consortium	0%	0%
Health/medical library	4%	12%
Law library	2%	0%
Corporate library	3%	12%
Federal, state, or local government library	6%	8%
Other special library	4%	0%
Other	3%	7%

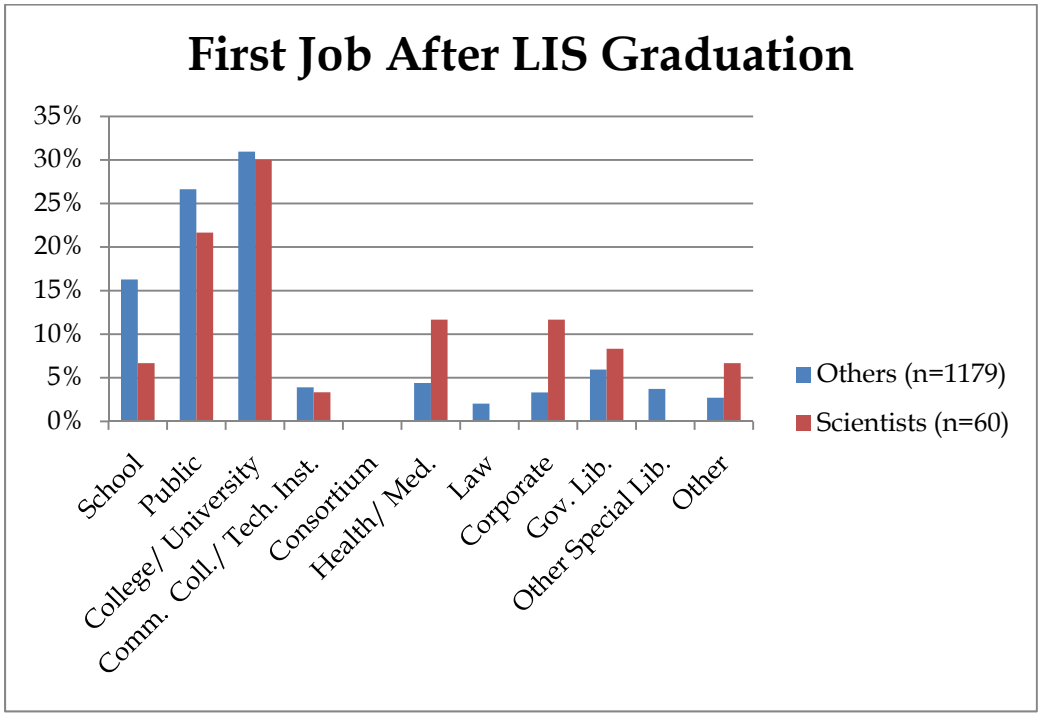

Figure 10: First Job After LIS Graduation

As the number of respondents decreased during the long survey, and because the skip pattern prevents duplication of questions for equivalent categories (e.g., current job=first job), it became more challenging to achieve statistical significance for differences of seemingly large magnitude. One setting question illustrated this issue. Former science majors did seem to differ from others on whether the job setting immediately following graduation was a government or private organization.

Qd_1b: Were you [an employee of…]

Frequency

	Private, for-profit company	Private not-for-profit	Local gov't	State gov't	Federal gov't	Self-employed (not incorp.)	Responses
Others	233	218	373	483	44	5	1356
Scientists	21	12	13	25	5	0	76
-All-	254	230	386	508	49	5	1432

Share of Responses

Others	0.1718	0.1608	0.2751	0.3562	0.0324	0.0037	1356
Scientists	0.2763	0.1579	0.1711	0.3289	0.0658	0.0000	76
-All-	0.1774	0.1606	0.2696	0.3547	0.0342	0.0035	1432

Test Response Homogeneity

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	9.6838	0.0847
Pearson	10.0910	0.0727

As shown above, 28% of science majors versus 17% of all others found work in a non-traditional setting at a private, for-profit company after receiving the LIS degree. Conversely, 17% of scientists and 28% of others found employment for local government (mostly in school or public libraries). Former science graduates were also twice as likely to work for the federal government versus others.

Current job setting

In line with their expressed preferences on entering LIS programs, science graduates eventually move toward significant differences in current employment. Those who worked in a library were asked to classify the type as follows.

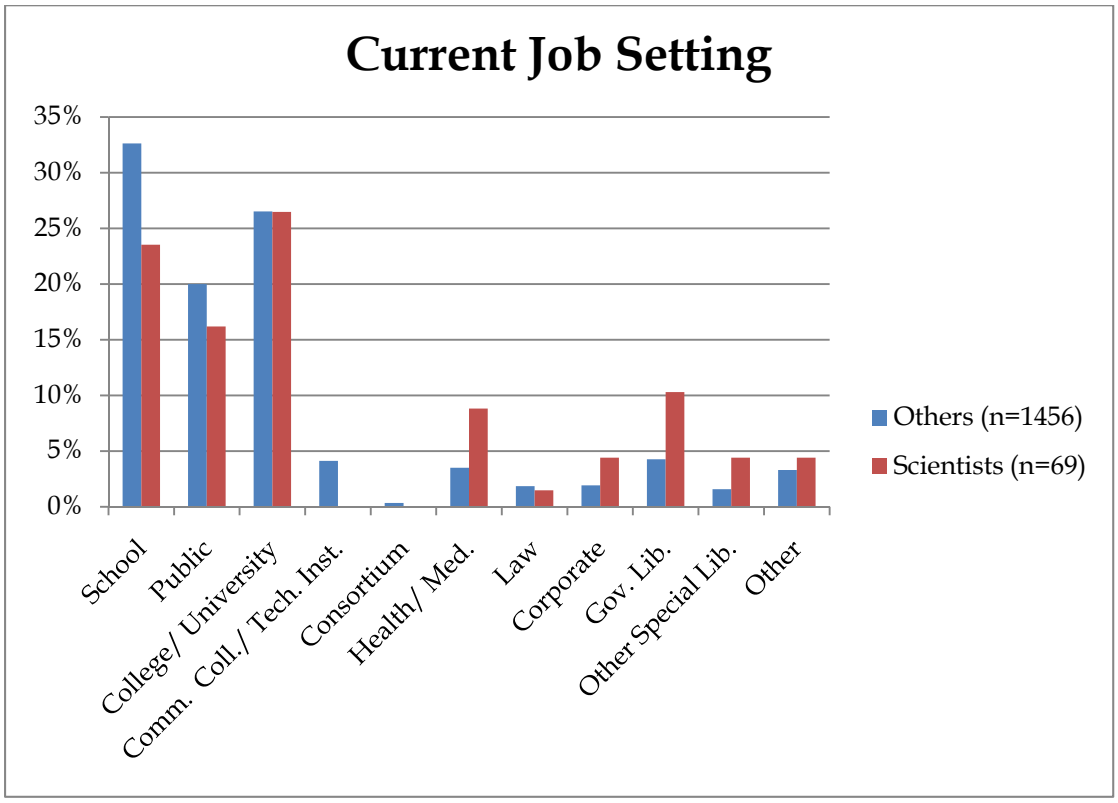

Figure 11: Current Job Setting

Science graduates were less likely to work in a school media center (24% versus 33%) or a less-academically-rigorous community college library (0% versus 4%). Science degree holders were twice as likely to work in special libraries (excluding law libraries): health science libraries (8% versus 4%), corporate libraries (4% versus 2%), government (10% versus 4%), or other special libraries (4% versus 2%). Current employment percentages were similar for scientists and nonscientists in public libraries, academic libraries, consortia, and law libraries.

There have been changes in librarianship over the years, so that a growing population has built more schools and public libraries at the same time as special libraries, particularly those in corporate settings, have greatly reduced in number. Governments

remain the predominant employer for all groups. As a result, there were no significant differences in the profit/non-profit status of libraries where the three groups worked most currently (at the time of the survey).

Job setting: Motivations to enter an LIS program

While science graduates collectively claimed few differences in motivations to enter an LIS program, there were stronger correlations between motivations and job setting. The following analyses for all respondents (science and non-science) show highly significant differences.

LIS professionals can and often do move between library settings during the course of the career. While motivations to pursue LIS studies might be expected to correlate with preferred job setting on entering the program, it may also be insightful to examine whether such correlations remain for the "current" job, the result of more considered choices and experience.

No differences were found by initially preferred job setting for the impact of a guidance counselor, family member or friend recommendation, recruitment by LIS program, or "seemed like a good fit for my interests." These factors seemed equally important across preferred job settings.

Those with family members or friends working in LIS and those motivated by an interest in computers began LIS studies with significantly different preferred job settings, but by the time the "current job" was reached these factors no longer impacted the job setting selected. By contrast, four factors began with and maintained differences in the distribution by job setting: "always wanted to be a librarian," "like working with people,"

"wanted a job where I could make a difference," and "worked as an assistant in a library or information center."

Setting: Family member or friend worked in LIS

Preferred setting when entered LIS program	Not at all	A little	A moderate amount	A lot	Respondents
Public library	0.5740	0.1412	0.1230	0.1617	439
College/ university library	0.5609	0.1163	0.1382	0.1847	731
School library	0.5240	0.1010	0.1326	0.2424	792
Corporate library	0.6145	0.0723	0.0843	0.2289	83
Law library	0.5116	0.1163	0.1163	0.2558	43
Health sciences library	0.5921	0.0789	0.1316	0.1974	76
Other special library	0.6300	0.1300	0.1000	0.1400	100
Archives or records management	0.5769	0.1667	0.1410	0.1154	78
Non-library workplace	0.7719	0.0702	0.1053	0.0526	114
No preferred workplace	0.6453	0.1279	0.0814	0.1453	172

Test Response Homogeneity

Column	Pearson ChiSquare	Prob>ChiSq
A6B: Family member or friend worked in LIS	62.7012	0.0001

Those who expressed a preference for school or law libraries when entering the LIS program were more likely to have been influenced by a family member or friend already in the field. Perhaps not surprisingly, those expressing preference for non-library careers were least influenced by knowing someone in the field.

Knowing someone in LIS might have influenced preferred setting on LIS program entry, but the impact appears short-lived. There was no relationship with "current setting" ($p=0.38$).

Setting: "Always wanted to be a librarian"

Significantly fewer scientists had "always wanted to be a librarian." Was there a preferred job setting for those (of any major) who had always wanted to join the field?

Preferred setting when entered LIS program	Not at all	A little	A moderate amount	A lot	Respondents
Public library	0.3485	0.2278	0.1959	0.2278	439
College/ university library	0.4781	0.2336	0.1516	0.1366	732
School library	0.3312	0.2469	0.1814	0.2406	794
Corporate library	0.5488	0.2073	0.1585	0.0854	82
Law library	0.6279	0.1628	0.0698	0.1395	43
Health sciences library	0.4605	0.1842	0.1974	0.1579	76
Other special library	0.5354	0.2222	0.1111	0.1313	99
Archives or records management	0.4103	0.3205	0.1795	0.0897	78
Non-library workplace	0.7982	0.1140	0.0702	0.0175	114
No preferred workplace	0.5872	0.2558	0.0930	0.0640	172

Test Response Homogeneity

Column	Pearson ChiSquare	Prob>ChiSq
A6D: Always wanted to be a librarian	186.884	<.0001

These differences were highly statistically significant. Those who had long been drawn to librarianship were drawn to the most stereotypical library settings with the greatest public exposure: school and public libraries. Corporate libraries and archives are least like the stereotypical library, and they drew smaller proportions of those who had always dreamed of the career. Not surprisingly, the least influence of this factor was on those who preferred not to work in any library at all.

As careers progressed, those who had always wanted to be a librarian became more open to less traditional settings. As a result, while the differences in setting remained significant, the magnitude of such differences decreased. Because the listed options for "current setting" did not exactly match those for "preferred setting," comparisons are not all exact. Only those who claimed to currently work in a library or information center were asked this question; non-library employees were not included.

Current job	Importance of "always wanted to be a librarian" Not at all	A little	A moderate amount	A lot	Respondents
School library/ media center	0.3750	0.2254	0.1660	0.2336	488
Public library	0.3721	0.2625	0.1993	0.1661	301
College/ university library	0.4988	0.2481	0.1315	0.1216	403
Community college/ technical institute library	0.4500	0.2333	0.1167	0.2000	60
Consortium	0.2000	0.4000	0.4000	0.0000	5
Health/ medical library	0.4107	0.2679	0.1607	0.1607	56
Law library	0.4643	0.3214	0.0714	0.1429	28
Corporate library	0.4516	0.2258	0.1613	0.1613	31
Federal, state, or local government library	0.4783	0.2464	0.1739	0.1014	69
Other, special library	0.2308	0.3077	0.1538	0.3077	26
Other	0.4600	0.2800	0.1200	0.1400	50

Test Response Homogeneity

Column	Pearson **ChiSquare**	**Prob>ChiSq**
A6D: Always wanted to be a librarian	49.3423	0.0145

While those who had always wanted to be librarians remained well-represented in schools, public libraries lost some of those who had dreamed of librarianship since childhood. Many of those with long-standing interest in librarianship moved into non-traditional corporate and "other special" library settings.

Setting: Like working with computers

Scientists were more likely to cite interest in computers as a motivating factor in the decision to enter an LIS program. Computer interest also corresponds with preferred job setting.

Preferred setting when entered LIS program	Not at all	A little	A moderate amount	A lot	Respondents
Public library	0.5747	0.2253	0.1402	0.0598	435
College/ university library	0.4713	0.1958	0.2112	0.1217	715
School library	0.4237	0.2023	0.2392	0.1349	786
Corporate library	0.4578	0.1325	0.2530	0.1566	83
Law library	0.5116	0.2326	0.0698	0.1860	43
Health sciences library	0.3867	0.2267	0.2533	0.1333	75
Other special library	0.5354	0.1818	0.2121	0.0707	99
Archives or records management	0.4026	0.2727	0.1818	0.1429	77
Non-library workplace	0.0609	0.0522	0.2783	0.6087	115
No preferred workplace	0.4201	0.1775	0.2249	0.1775	169

Test Response Homogeneity

Column	Pearson ChiSquare	Prob>ChiSq
A6f. Like working with computers	305.441	<.0001

Those who hoped to work outside a library were drawn to LIS studies by interest in computers. By contrast, those interested in public libraries or "other special libraries" were generally not motivated by computer interest. Those with other preferred library settings were more similar with respect to interest in computers as motivation.

As several individuals mentioned in comments, computers were not widespread when older respondents entered LIS studies and could not have been a motivation for some. Further, computers are used in almost every setting and nearly all LIS professionals may be expected to work with them. Perhaps as a result, job setting was NOT significantly correlated with computer interest for those who currently work in libraries or information centers. (p=0.08)

The type of employer for the "current job" does show highly significant correlation. A larger proportion of those mostly strongly motivated by interest in computers currently hold jobs in private industry.

	Importance of motivation "like working with computers"				
Current type of employer	Not at all	A little	A moderate amount	A lot	Respondents
Private, for-profit company	0.2762	0.2218	0.2720	0.2301	239
Private not-for-profit organization	0.4642	0.2034	0.1920	0.1404	349
Local government	0.4864	0.2205	0.1932	0.1000	440
State government	0.3911	0.2051	0.2405	0.1633	790
Federal government	0.5181	0.2048	0.1566	0.1205	83
Self-employed (not incorporated)	0.7111	0.0889	0.1333	0.0667	45
Self-employed (incorporated)	0.5217	0.2174	0.0435	0.2174	23
Working without pay (family business)	0.0000	0.5000	0.5000	0.0000	2

Test Response Homogeneity

Column	Pearson ChiSquare	Prob>ChiSq
A6f. Like working with computers	72.5481	<.0001

Setting: Like working with people

Science graduates as a whole were not significantly different from others in claiming that a desire to work with people contributed to the decision to seek an LIS career. By contrast, those who preferred different job settings did show significant differences in this factor.

Preferred setting when entered LIS program	Not at all	A little	A moderate amount	A lot	Respondents
Public library	0.0727	0.1227	0.3705	0.4341	440
College/ university library	0.1067	0.1710	0.3871	0.3352	731
School library	0.0652	0.0689	0.3321	0.5338	798
Corporate library	0.2410	0.1446	0.3614	0.2530	83
Law library	0.0698	0.2093	0.3488	0.3721	43
Health sciences library	0.1447	0.1974	0.2368	0.4211	76
Other special library	0.1414	0.2222	0.2929	0.3434	99
Archives or records management	0.1667	0.1923	0.4103	0.2308	78
Non-library workplace	0.3158	0.1754	0.2719	0.2368	114
No preferred workplace	0.2326	0.2151	0.3721	0.1802	172

Test Response Homogeneity

Column	Pearson ChiSquare	Prob>ChiSq
A6g. Like working with people	250.211	<.0001

As might be expected, those who were least motivated to work with people initially preferred job settings where the number of patron interactions might be expected to be lower: non-library settings, archives and records management positions, and corporate libraries. Perhaps surprisingly, those preferring law librarianship, not generally a public setting, were strongly motivated to work with people.

Those with different levels of social motivation not only began with differences in job setting preference but remained stratified by setting as the career progressed. The table below shows job setting only for those who currently work in libraries.

Current job	Importance of motivation "like working with people" Not at all	A little	A moderate amount	A lot	Respondents
School library/ media center	0.0532	0.0859	0.3436	0.5174	489
Public library	0.1060	0.1126	0.3841	0.3974	302
College/ university library	0.1219	0.1891	0.3682	0.3209	402
Community college/ technical institute library	0.0833	0.2833	0.2833	0.3500	60
Consortium	0.0000	0.2000	0.6000	0.2000	5
Health/ medical library	0.1429	0.1607	0.2857	0.4107	56
Law library	0.0714	0.1071	0.5000	0.3214	28
Corporate library	0.2581	0.2903	0.2903	0.1613	31
Federal, state, or local government library	0.2029	0.2754	0.3913	0.1304	69
Other, special library	0.0769	0.1538	0.5385	0.2308	26
Other	0.1600	0.1000	0.4000	0.3400	50

Test Response Homogeneity

Column	Pearson ChiSquare	Prob>ChiSq
A6g. Like working with people	124.965	<.0001

Some who were least motivated to work with people continued to be drawn to corporate libraries, and others gravitated toward two settings not included in the initial preferred list: government libraries and consortia. Settings correlated with strong people motivation initially retained high proportions.

Differences in social motivation corresponded to the current type of employer even when settings other than libraries were included. Those who most liked working with people more often currently work for local government (most likely in public or school libraries) and less often work in for-profit organizations.

Current type of employer	Importance of motivation "like working with people" Not at all	A little	A moderate amount	A lot	Respondents
Private, for-profit company	0.1841	0.2134	0.3305	0.2720	239
Private not-for-profit organization	0.0969	0.1852	0.3818	0.3362	351
Local government	0.0960	0.0960	0.3862	0.4219	448
State government	0.1075	0.1264	0.3515	0.4147	791
Federal government	0.1765	0.2471	0.3647	0.2118	85
Self-employed (not incorporated)	0.2128	0.1489	0.2766	0.3617	47
Self-employed (incorporated)	0.0800	0.1200	0.4000	0.4000	25
Working without pay (family business)	0.0000	0.0000	0.5000	0.5000	2

Test Response Homogeneity

Column	Pearson ChiSquare	Prob>ChiSq
A6g. Like working with people	70.1705	<.0001

Preferred setting: Wanted a job where I could make a difference

No difference emerged between science graduates and others for wanting to "make a difference." By contrast, those with different preferred job settings showed a highly significant variability in the importance of "making a difference." Future teacher-librarians showed the highest motivation in this category. This motivation was also important to those desiring work in public, academic, and health science libraries. Those attracted to "other special libraries" were strongly motivated to make a difference; this category includes libraries for government agencies and non-profit organizations. Libraries perhaps less likely to be associated with a "cause" include archives, law libraries, corporate libraries, and non-library settings; those attracted to those settings were least likely to be driven to "making a difference." While these differences are statistically significant, it should be emphasized that most LIS professionals regardless of preferred setting wanted to "make a difference" in their careers.

Preferred setting	Not at all	A little	A moderate amount	A lot	Respondents
Public library	0.1000	0.1705	0.3409	0.3886	440
College/ university library	0.1231	0.2134	0.3228	0.3406	731
School library	0.0804	0.1118	0.2977	0.5101	796
Corporate library	0.1928	0.2530	0.2892	0.2651	83
Law library	0.1395	0.2093	0.3953	0.2558	43
Health sciences library	0.1299	0.1818	0.3117	0.3766	77
Other special library	0.1313	0.1919	0.2727	0.4040	99
Archives or records management	0.1154	0.1923	0.3974	0.2949	78
Non-library workplace	0.2435	0.2087	0.2957	0.2522	115
No preferred workplace	0.1860	0.2035	0.3430	0.2674	172

Test Response Homogeneity

Column	Pearson ChiSquare	Prob>ChiSq
A6h. Wanted a job where I could make a difference	125.848	<.0001

When the desire to make a difference is correlated with the "current" job, an interesting observation emerges. Consortia jobs were sought by individuals who wanted to "make a difference;" this setting had not been listed under the initial preferred setting options. Ambivalent individuals moved into positions in legal and government libraries, while those largely indifferent to such concerns dominated corporate libraries.

	Importance of motivation to "make a difference"				
Current job	Not at all	A little	A moderate amount	A lot	Respondents
School library/ media center	0.0695	0.0982	0.3333	0.4990	489
Public library	0.1060	0.1523	0.3245	0.4172	302
College/ university library	0.0945	0.2488	0.3284	0.3284	402
Community college/ technical institute library	0.1333	0.1833	0.2833	0.4000	60
Consortium	0.0000	0.0000	0.4000	0.6000	5
Health/ medical library	0.1071	0.1250	0.3393	0.4286	56
Law library	0.1429	0.3214	0.3214	0.2143	28
Corporate library	0.3226	0.2581	0.2258	0.1935	31
Federal, state, or local government library	0.1884	0.2029	0.4348	0.1739	69
Other, special library	0.1154	0.2308	0.3846	0.2692	26
Other	0.1800	0.1000	0.4400	0.2800	50

Test Response Homogeneity

Column	Pearson ChiSquare	Prob>ChiSq
A6h. Wanted a job where I could make a difference	110.678	<.0001

Those most concerned with "making a difference" are significantly more likely to currently hold public service employment in state and local government and charitable organizations.

	Importance of motivation for "making a difference"				
Current type of employer	Not at all	A little	A moderate amount	A lot	Respondents
Private, for-profit company	0.1925	0.2427	0.2678	0.2971	239
Private not-for-profit organization	0.1083	0.1909	0.3704	0.3305	351
Local government	0.1007	0.1365	0.3266	0.4362	447
State government	0.0934	0.1705	0.3157	0.4205	792
Federal government	0.1765	0.1882	0.4118	0.2235	85
Self-employed (not incorporated)	0.1064	0.2340	0.3830	0.2766	47
Self-employed (incorporated)	0.2800	0.2000	0.1600	0.3600	25
Working without pay (family business)	0.0000	0.5000	0.0000	0.5000	2

Test Response Homogeneity

Pearson

Column	ChiSquare	Prob>ChiSq
A6h. Wanted a job where I could make a difference	68.6673	<.0001

Preferred setting: Worked as an assistant in a library or information center

Science graduates and others were equally likely to cite experience as a library assistant as motivation to pursue LIS studies. One might expect settings hiring more assistants to attract more future workers. Those motivated the most by such experience were significantly more likely to be drawn to settings which tend to hire paraprofessionals: public, academic, and health science libraries, as well as law libraries where library assistants/paralegals may use complex LIS skills. Settings where librarians work with few or no paraprofessional assistants—school and corporate libraries—were least likely to attract those who cited paraprofessional experience. Those who preferred to work outside of libraries after graduation were the least likely to cite prior library work as a motivator.

Preferred setting	Not at all	A little	A moderate amount	A lot	Respondents
Public library	0.3152	0.0680	0.1429	0.4739	441
College/ university library	0.3492	0.0832	0.1378	0.4297	733
School library	0.5730	0.0932	0.1083	0.2254	794
Corporate library	0.4578	0.1325	0.1325	0.2771	83
Law library	0.3721	0.0465	0.0930	0.4884	43
Health sciences library	0.3684	0.0263	0.0658	0.5395	76
Other special library	0.3900	0.1100	0.1100	0.3900	100
Archives or records management	0.4231	0.1026	0.1410	0.3333	78
Non-library workplace	0.7632	0.0965	0.0877	0.0526	114
No preferred workplace	0.6279	0.0756	0.1047	0.1919	172

Test Response Homogeneity

Pearson

Column	ChiSquare	Prob>ChiSq
A6j. Worked as an assistant in a library or information center	241.392	<.0001

Even well into the career, differences remained in job setting for those who had experience as a paraprofessional prior to entering an LIS program. Public, academic, and health science libraries continued to attract those who had worked in a library before entering the LIS program, and school libraries did not attract such individuals.

	Importance of prior LIS experience as motivation				
Current job	Not at all	A little	A moderate amount	A lot	Respondents
School library/ media center	0.5307	0.0943	0.1270	0.2480	488
Public library	0.3808	0.0695	0.1258	0.4238	302
College/ university library	0.3657	0.0846	0.1020	0.4478	402
Community college/ technical institute library	0.4333	0.0167	0.1333	0.4167	60
Consortium	0.6000	0.0000	0.4000	0.0000	5
Health/ medical library	0.2982	0.0877	0.1053	0.5088	57
Law library	0.3214	0.0714	0.2143	0.3929	28
Corporate library	0.2903	0.1290	0.0323	0.5484	31
Federal, state, or local government library	0.4203	0.0725	0.0725	0.4348	69
Other, special library	0.3846	0.0385	0.1538	0.4231	26
Other	0.3922	0.0980	0.2157	0.2941	51

Test Response Homogeneity

	Pearson	
Column	**ChiSquare**	**Prob>ChiSq**
A6j. Worked as an assistant in a library or information center	81.2278	<.0001

Job and career satisfaction

Are those with science background who joined LIS happy with their fate? In a survey of academic science librarians, 67% of whom had a science degree, 69% stated it was "very likely" they would continue working as a science librarian, and 23% said it was somewhat likely. (Beck & Callison, 2007)

For the WILIS sample, although the vast majority chose to remain in a traditional LIS position, a small number moved on to another career. Recall that only 10% of science majors and 13% of others currently employed claimed a position that was neither librarian nor information professional. Several survey items explored satisfaction with the

current employer (LIS or not) and the choice of profession. Respondents equally report satisfaction, regardless of undergraduate subject background.

Current job satisfaction

Those with and without a science background were happy with the current work environment. They were satisfied with what they did on the job and still liked the current job. While the science graduates leaned slightly more positive, the difference was not statistically significant.

LIS career satisfaction

Several survey questions approached career satisfaction. Science majors were no different from others in overall satisfaction with the LIS career, liking being an LIS professional, or intent to leave the profession.

Importantly, despite far lower numbers who claimed they had “always wanted to be a librarian,” those with science background were equally likely to say that “If I had to do it over again, I would choose LIS as a career.” They are equally likely to encourage others to choose LIS as a career.

Discussion of Common Themes and Implications

Summary of findings

Each of the three main research questions are now addressed in turn.

Motivations to pursue LIS

What are the similarities and the differences in factors motivating the decision to seek an LIS career for individuals holding undergraduate degrees in the natural sciences versus those who do not?

The WILIS study results point to more similarities than differences between those with and without a degree in the sciences. No difference was found for most contextual factors such as family considerations, personal health or disability, the frequency with which others recommended LIS and even personal experience in a library.

While the overall shape of the career was the same between groups, there were some indications that science graduates faced slightly more instability with respect to job security in the position held immediately prior to LIS studies. Overall, however, science graduates were not any less satisfied with aspects of the "prior" job than others.

Those with a science background were far less likely to cite they had "always wanted to be a librarian;" however, once they became aware of the intrinsic benefits of an LIS career, they embraced it wholeheartedly and never looked back. Few left the LIS career, and the ones who stayed expressed high levels of career satisfaction.

Scientists were motivated in greater numbers by computer interest. They were more likely to receive IS degrees, although most still earned the MLS.

The general take-away from this finding is that science graduates or science majors should not be unnecessarily excluded from recruiting efforts. The LIS profession has gained professionals from the sciences who cite many of the same motivations as their peers who trained in other fields. Scientific employment is not always the land of plenty, particularly for women, and those with scientific training may quite reasonably choose to pursue alternate careers for either personal and financial reasons.

Job satisfaction

Which factors linked to anticipated and experienced job satisfaction were valued differently by scientists who became librarians?

When asked about extrinsic and intrinsic contributors to job satisfaction, librarians with and without a science background showed overwhelming agreement. Factors such as scheduling, autonomy, the importance of social interaction and social good, opportunities for advancement, and interest in the work itself were equally important to both groups.

Highly significant differences in preferred work settings point to some difference in work values, but the motivating reasons for these differences do not appear to have been explicitly captured by the items in the WILIS survey.

According to a recent article, “Having just completed a multiyear study tracking the day-to-day activities, emotions, and motivation levels of hundreds of knowledge workers in a wide variety of settings, we now know what the top motivator of performance is—and, amazingly, it’s the factor those survey participants ranked dead last. It’s *progress*.

On days when workers have the sense they're making headway in their jobs, or when they receive support that helps them overcome obstacles, their emotions are most positive and their drive to succeed is at its peak. On days when they feel they are spinning their wheels or encountering roadblocks to meaningful accomplishment, their moods and motivation are lowest." (Amabile & Kramer, 2010) The feeling of progress was a better motivator than recognition, incentives, interpersonal support, clear goals, or "important work."

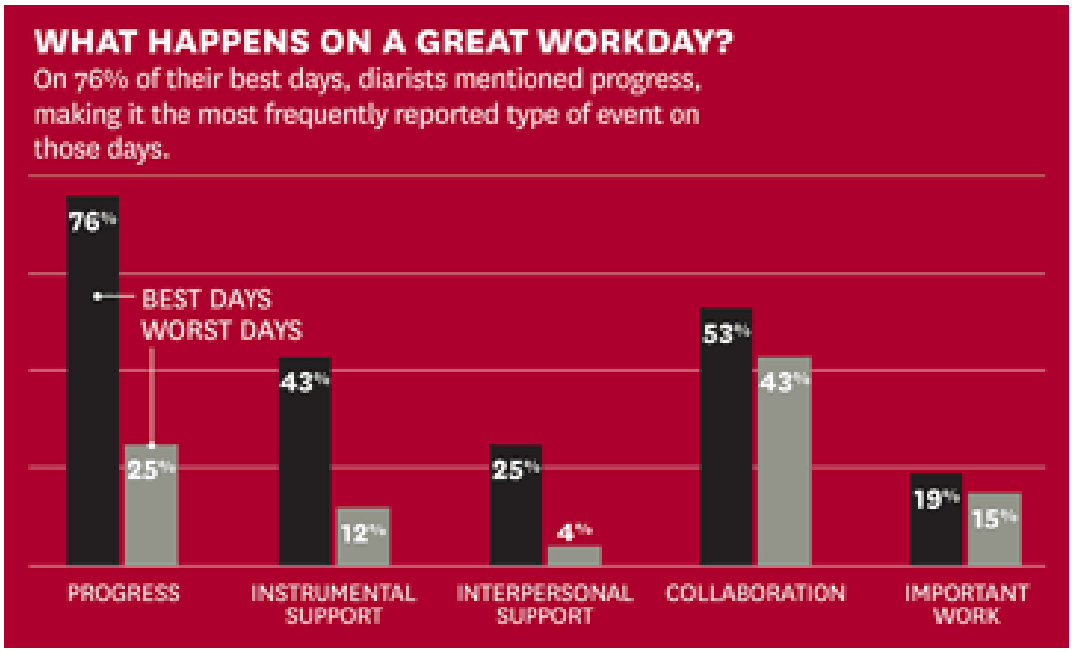

Figure 12: Importance of "progress" (reprinted from Amabile & Kramer, 2010)

Librarianship offers a unique opportunity for relatively instant gratification. Intellectual opportunities and access to the world's knowledge can be obtained, some of the most critical motivators of librarians in prior research (Heim & Moen, 1989), without planning and conducting one's own experiments. Answers can be located and patrons satisfied on a daily basis, whereas the pace of scientific discovery (or the routine of quality control and other non-research science) does not offer such consistent reward. In a

special library setting with its usually smaller clientele, librarians can develop closer relationships with patrons and perhaps get more steady feedback about the real impact of their work and the value of their subject expertise.

Job setting/role

Are scientists-turned-librarians more likely to seek employment in certain types of libraries (e.g. academic versus school) and in certain roles? Which environments and roles are most attractive to them? What does this tell us about perceptions of library types and roles?

Science graduates were relatively more likely to claim identification as information professional, although the role of librarian remains dominant for scientists and others. In harmony with increased computer interest, scientists were more likely than others to claim responsibilities for database development and for “other” IT and consulting work. Overall, however, responsibilities were quite similar between groups.

A larger proportion of science graduates claimed responsibility for academic research and publications. The implications of this will be further discussed below.

The most striking differences between science graduates and others were found with respect to job setting, both preferred and obtained. Scientists showed reduced preference for and employment in school libraries throughout their careers. They also showed greater interest and employment in special libraries.

The common thread was that science graduates preferred settings where they would be less likely to answer routine questions requiring retrieval of general knowledge. They were less attracted to schools and community college libraries and more attracted to

libraries active in research, such as university and special libraries. Evidence for special interest in research and analysis is supported by scientists' greater reported participation in academic research and publications. Science graduates may be influenced by narratives such as that given in the ACS publication mentioned earlier in this paper; they are more strongly drawn to become "information professionals" who collaborate with researchers to analyze and create knowledge. Many still want to "do science" even if they do not enjoy working in a lab. Such a drive may come from a different epistemological and philosophical orientation than is commonly held within the LIS profession, a drive toward empiricism and occasionally individualistic motives. The dominant ethos of librarianship, by contrast, is focused on collectivism and social construction of community narratives and resources.

Analysis limitations and suggestions for further research

While this analysis was conducted with a rich data source, no research is conducted without limitations. Several of the most salient limitations follow.

Secondary analysis

The WILIS survey was designed and administered well before this researcher joined the study group. Because this paper is a secondary analysis, new coding was required, and some desirable variables were not found in the study. In particular, science libraries other than health science libraries were not explicitly identified by any survey item. While respondents were asked to provide job titles, not all did so, and even listed job titles did not always clearly indicate whether or not a position might have been science-related. Further, information was not collected for every job. As a result, the number of

former scientists who worked at some point in a science library could not be determined. While scientists-who-became-librarians and not science librarians were targeted for this analysis, such a variable would have proven interesting.

Sample representativeness/generalizability

While the sample size is large, it is not strictly representative of geography and library type. Graduates of North Carolina LIS programs came from and have moved to many other states and countries, but the sample remains weighted toward in-state residents. Academic librarians may also be over-represented, with their proportion of WILIS respondents equaling the number of school librarians and outnumbering public librarians even though ALA figures suggest the latter two groups are more numerous across the country. (American Library Association, 2010)

The author recommends that further research be conducted for alumni of schools in other states and other countries. Motivations might show regional cultural differences. To encourage such an effort, the WILIS team has published the survey instrument and a toolkit with instructions on best practices for conducting a similar career survey.

Self-report bias

The survey relies on self-report. As with any such survey, responses may be subject to framing effects and social desirability bias. Such bias may be particularly troublesome in career turnover research, as respondents may report inflated measures of satisfaction and of socially desirable motivations. (Arnold, Feldman, & Purbhoo, 1985) Pro-social extraversion has been shown to be inflated when non-librarians were told to “fake” a good response or specifically to answer like a librarian. (Furnham & Henderson, 1982;

Velicer & Weiner, 1975) In addition to social desirability bias, motivations to pursue a career might be further influenced by recollection bias, where the self-narrative is unconsciously revised to more closely correspond with the current self-concept or self-projection. Employers, including libraries, often explicitly make an effort to "socialize" employees so that their values and attitudes change to become in conformance with desired norms. (Chapman, 2009) Science majors represent a minority in librarianship and might change expressed or even internal values over time to suit the norms of the majority. "Staff members from diverse backgrounds may choose not to engage in conflict or not to voice non-conforming views for fear of sanctions." (Howland, 2001, p. 112)

For this reason, it may be useful for future researchers to survey incoming LIS students about their motivations to pursue the field before they are socialized by LIS faculty or future employers.

Intellectual motivation

While the survey examines a wide variety of needs and motivations affecting career decisions, no instrument can be comprehensive. Socio-cultural context was well-assessed by the survey, as were measures of security needs, social/belongingness needs, and achievement/esteem needs. The survey instrument included a variety of extrinsic and altruistic motivations, but did not explore in equal detail some motivations intrinsic to the work itself, motivations of a more self-serving nature such as the intellectual challenge of information seeking, the opportunity to learn about new things or to conduct research, and access to information for one's own use. These factors are somewhat distinct from the work being "interesting." As discussed earlier, other research has shown these

motivations important for LIS students, and scientists chose settings more likely to include such stimulation.

Future research might include measures of intellectual stimulation and other similar factors along with the rich selection of variables from the WILIS study, so that the relative importance of these factors might be discovered.

Job before/after LIS decision

The WILIS survey did not gather information about all jobs held. It asked about the job before LIS studies were begun, but a significant number of respondents had already begun to work in the LIS field; moreover, the majority of science graduates were not working in a scientific capacity in the "prior" job. As a result, one could not characterize the job prior to the LIS decision itself or characterize "science jobs" and compare satisfaction and workplace environments with employment in LIS-related positions.

Qualitative data/triangulation of findings

Free-form qualitative responses to the WILIS survey were generally brief and did not seem to uncover new themes. Future research might involve semi-structured interviews to further explore the reasons science graduates decided to pursue an LIS career. Additional studies might include a matched control group who remained in science careers to uncover differences in motivations and occupational values.

Conclusion

Science graduates who seek careers as librarians show more similarities than differences from their peers. Though they do show some differences in preferred job

setting, many of their career motivations are similar to non-scientists. Scientists can and do find the profession of librarianship rewarding once they discover it.

Former scientists are particularly drawn to special libraries. Recruiting those with a science background may help meet needs for hard-to-fill positions in special libraries, including science and health science libraries in an academic setting. In addition, former science graduates may bring an enthusiasm for research and for quantitative methodologies, giving them the potential to serve not only a specialized patron base but also the field of LIS as a whole.

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Appendix: Glossary of Acronyms

ACRL: Association of College & Research Libraries

ACS: American Chemical Society

ALA: American Library Association

ARL: Association of Research Libraries

ASIST: American Society for Information Science & Technology

BS: Bachelor of Science

Ed.S.: Educational Specialist

GRE: Graduate Record Exam

IMLS: Institute for Museum and Library Services

IS: Information Science

IT: Information Technology

LIS: Library and Information Science

LS: Library Science

MLS: Master of Library Science

MSIS: Master of Science in Information Science

MSLS: Master of Science in Library Science

Ph.D.: Doctor of Philosophy

SILS: School of Information and Library Science

SLA: Special Libraries Association

WILIS: Workforce Issues in Library and Information Science