Statistics Training in Library Science: Comparing Approaches in Library and Information Science to Sociology Graduate Programs

Jung Mee Park

Library and information science (LIS) research is becoming more quantitative. However, statistics is not extensively taught within LIS research methods courses, and statistics courses are uncommon within LIS programs. Previous research on statistics in LIS revealed that researchers have mainly relied on descriptive statistics in publications. This article argues that LIS's partner disciplines, such as sociology, emphasize statistical training more so than do LIS programs at the master's level. Sociology serves as an appropriate comparison to LIS because of its central status in the development of both qualitative and quantitative research methods and its relevance for library science. The author analyzed the curricular requirements of 109 master's degree programs (47 sociology and 62 LIS programs) and 81 research methods syllabi (60 in sociology and 21 in LIS). The analysis of master's in LIS (MLIS) and sociology MA curricula revealed that MLIS students took 0.6 research methods courses while sociology MA students took 2.7 methods courses. LIS programs typically required one methods course, whereas sociology MA programs required three. LIS methods courses spent on average 19% of instructional time on statistics, whereas 64% of sociology MA programs' instruction in methods focused on statistical analysis. 86% of LIS research methods courses covered descriptive statistics and only 38% of LIS courses discussed inferential statistics. Statistical training in LIS programs remains limited. LIS departments could approach statistical training as sociology has done by teaching inferential statistics and other advanced techniques. Thereafter, information professionals can publish more widely and provide improved research support.

Keywords: quantitative methods, inferential statistics, research methods, LIS curriculum, LIS graduate education, sociology graduate education

KEY POINTS:

- Only 58% of MLIS programs require students to take a research methods course.
- On average, MLIS students take one research methods course, while other disciplines such as sociology have master's students take three methods courses.
- About a fifth of LIS research methods courses' contents focus on quantitative methods, but the quantitative methods largely covered therein are descriptive statistics.

Introduction

Libraries curate and manage data. Library staff members offer statistical support, teach data literacy, and collaborate with other departments, including sociology, to teach statistical literacy (Burress, Mann, & Neville, 2020; Stephenson & Schifter Caravello, 2007). In Germany, master's programs in library and information science (LIS) have developed and taught courses on "searching and using data and statistics" (Kläre, 2017, p. 117). Yet very few American Library Association (ALA)-accredited LIS graduate programs teach statistics to master's in LIS

(MLIS) students. In this regard, LIS educators could examine other disciplines to better incorporate statistics into the MLIS curriculum.

LIS embraces interdisciplinary research and approaches (Chang, 2017; Larivière, Sugimoto, & Cronin, 2012; Lund, 2020). LIS and sociological methods overlap at times. Sociologists used bibliometric methods to study publication trends (Harker & Saffer, 2018; Strang & Siler, 2015). Sociologists helped to develop grounded theory which is commonly taught as part of qualitative methods training in LIS (Corbin & Strauss, 2008). Sociological theories regarding race, gender, and structural inequality serve as ideological basis for critical librarianship (Cronin, 2008; Ferretti, 2020). As social justice issues confronted librarians, LIS scholars began to closely examine sociological theories (Honma, 2005; Hussey, 2010). In addition to sociological theories, studying social statistics could help LIS students obtain more skills necessary to succeed as information professionals.

As one of LIS's partner disciplines (Larivière, Sugimoto, & Cronin, 2012), sociology is unique in that it routinely teaches applied statistics to MA students with little or no prior math experience. Graduate-level social statistics courses assume "no prior knowledge of statistics or mathematics beyond high school algebra" (Best, 2020). As flexibility within the LIS curricula grows to allow MLIS students to take graduate courses from outside departments (Arizona, 2020; Denver, n.d.), comparing how the methods curricula differ between LIS and sociology could help inform LIS students looking to bolster their statistical skills.

This article compares the instruction in research methods and specifically master's-level statistics curricula between LIS and sociology. The significance of this study includes extending the importance of statistics into existing debates regarding LIS research methods training. This study contextualizes why LIS students should study more statistics, presents new data regarding instructional time spent on statistics, and compares statistical training in LIS and sociology. The examples from sociology could inform the future direction of statistics training in LIS.

Literature review

Research methods courses have been taught as core or elective requirements at select ALA-accredited programs (Alemanne & Mandel, 2018; Mandel, 2017; Matusiak & Bright, 2020; Park, 2004). The ALA's "Standards for Accreditation of Master's Programs in Library and Information Studies" (2019) emphasize programs' needs to teach "professional practice and associated areas of study and research" (ALA, 2019, p. 2). The term "research" encompasses the "(1) inclusiveness of scholarly activities of a wide variety" (ALA, 2019, p. 2). Research is "(2) inclusive of communication of results through appropriate means" (ALA, 2019, p. 2). The LIS curriculum is meant to include "an evolving body of knowledge that reflects the findings of basic and applied research from relevant fields" (ALA, 2019, p. 5). LIS embraces interdisciplinary approaches. The ALA defines studying the "fundamentals of quantitative and qualitative research methods" as being among the librarians' core competencies (ALA, 2010).

Scholars have examined the usefulness of research methods courses in the LIS curriculum (Park, 2003; Alemanne & Mandel, 2018; Matusiak & Bright, 2020). However, statistics has had a limited role within the methods training discussion in the LIS literature

(Van Epps, 2012). Perhaps due to the broad guidelines of the ALA, LIS programs lack a consistent curriculum for teaching research methods (Matusiak & Bright, 2020). There is a particular need to emphasize research methods and statistical training to help information professionals understand the increasingly data-driven academic disciplines and properly evaluate new sources of information.

Statistical methods in LIS research

According to 30% of LIS professionals surveyed, "basic data-collection methods" remain one of the most important skills needed for librarians (Saunders, 2019, p. 11).[1] Previous studies revealed that 60% of MLIS programs in the United States required students to take a research methods course (Park, 2004). Most MLIS programs continue to require only one research method course (Matusiak & Bright, 2020). Previous research had not discussed how much instructional time was devoted to teaching statistics. Statistical calculation errors or misinterpretations of the findings were common in LIS publications (Van Epps, 2012). Other statistical errors in the LIS literature included poor data selection such as drawing conclusions from a small sample (Van Epps, 2012). Mishandling missing data was another concern (Van Epps, 2012).

Academic librarians publish to obtain tenure, but not all MLIS programs include research methods as a required course (Kennedy & Brancolini 2018; Kumaran, 2019). About 17% (from a survey of 659) of academic librarians believed that the MLIS adequately prepared them to conduct original research (Kennedy & Brancolini, 2018). A survey of 305 of academic librarians found that 48% of the respondents were required to take a research methods course as part of their MLIS degree (Crampsie, Neville, & Henry, 2020). Even among librarians who completed a research methods course in graduate school, many lacked confidence in their ability to conduct research (Ackerman, Hunter, & Wilkinson, 2018; Kennedy & Brancolini, 2018; Matusiak & Bright, 2020).

Although interest in statistics increased among academic librarians, most librarians avoided statistics intensive research projects (Ackerman et al., 2018; Crampsie et al., 2020). About 53% of academic librarians took at least one statistics course, but about half (46%) of those that took statistics did so as undergraduate students (Kennedy & Brancolini, 2018). However, 46% (from a survey of 213) academic librarians responded that the lack of research skill/knowledge was a challenge to conducting research (Ackerman et al., 2018). The majority (76%) of academic librarians conducting research used surveys to collect data (Ackerman et al., 2018). Ackerman, Hunter, and Wilkinson noted that the "heavy reliance on surveys may be a reflection of librarians' lack of training in or confidence with other research methods" (Ackerman et al., 2018, p. 556). Experiments (31.4%), questionnaires (18.2%), and citation analysis/bibliometrics (13.8%) were the top three data collection methods in 1,196 LIS publications in 2018 (Ma & Lund, 2020).

In the past two decades, LIS researchers have increased their use of statistical methods. Around 65% of the articles published in 20 higher profile LIS journals used quantitative methods, including statistics (Hider & Pymm, 2008). In an analysis of 1,497 LIS publications, the use of statistical methods increased from 242 (16.2%) in 1999–2003, 553 (36.9%) in 2004–2008, to 702 (46.9%) in 2009–2013 (Zhang, Wang, & Zhao, 2017). Recent

examination of review articles revealed that only 10 of 58 reviews in LIS used statistical methods, 72% of which relied solely on descriptive statistics (Ullah & Ameen, 2018).

The use of inferential statistics in LIS research is growing (Zhang, Wang, Zhao, & Cai, 2018).[2] However, academic librarians expressed low confidence in their abilities to analyze "data using statistical tests (*t*-test, Chi-squared, ANOVA, etc.)" (Crampsie et al., 2020, p. 253). In a study of 343 LIS articles published in five journals, 70% of the empirical articles used quantitative methods which included descriptive statistics, inferential statistics, or experimental evaluations (Togia & Malliari, 2017).[3] Dilevko (2007) found that 14.5% of the articles published in five LIS journals from 2001–2005 used inferential statistics.[4] A 2017 study found that 18.5% of randomly sampled empirical articles used inferential statistics (Togia & Malliari, 2017). Researchers in LIS subfields such as scientometrics, bibliometrics, and information retrieval have advanced the use of inferential statistics (Zhang et al., 2017). 1,308 articles out of 5,175 (25.3%) sampled from 1999–2013 included inferential statistics such as *t*-tests, Chi-square, and ANOVA (Zhang et al., 2017). Dilevko (2007) and Zhang et al. (2017) studied different sets of journals, yet both studies found that LIS researchers favored using *t*-tests and Chi-square as inferential statistical tests.[5]

Furthermore, training in statistics can benefit librarians as information intermediators and consumers of academic research (Park, 2003; Rubenstein, 2018). Information professionals conduct research and support faculty and student researchers from other departments (Brown, Wolski, & Richardson, 2015). Academics, journalists, and the lay public often misunderstand statistics (Diong, Butler, Gandevia, & Héroux, 2018; Gelman & Nolan, 2017). Thus, information literacy which includes statistical literacy, is a crucial skill for librarians (Koltay, 2017). MLIS graduates who opt to work as reference or liaison librarians may need to read more literature from other fields that use statistics (Johnson, 2020). In non-LIS fields, about 69% of published articles included quantitative analysis (Zhang et al., 2017). Information professionals need to understand journal articles that incorporate inferential statistics from various fields (Zhang et al., 2017). As patrons come to libraries to investigate a wide range of issues including health, financial, and housing information, the ability to evaluate statistics becomes essential for librarians (Abrahamson, Fisher, Turner, Durrance, & Turner, 2008; Calzada Prado & Marzal, 2013). For librarians who serve as information intermediaries, statistical knowledge becomes yet another needed skill (Alemanne & Mandel, 2018; Dilevko, 2007; Rubenstein, 2018).

Statistical methods in sociology

Like LIS, sociologists publish qualitative and quantitative research (Jacques, 2014; Schwemmer & Wieczorek, 2019). Schwemmer and Wieczorek (2019) found that generalist journals in sociology published 256 qualitative and 200 quantitative research-based articles.[6] However, the use of statistical analysis in sociology publications increased from 1995 to 2017 (Schwemmer & Wieczorek, 2019). Sociology departments adapted their curriculum to add statistical training in the early 2000s (Moran, 2005).[7] Although qualitative research remains important in sociology, the majority of master's-level sociology students have taken at least one statistics class because many sociology MA graduates planned to pursue careers in research and teaching (Schwemmer & Wieczorek, 2019; Spalter-Roth & Van Vooren, 2009).

According to the American Sociological Association (ASA)'s report, students considered statistics courses to be as integral as theory courses (ASA, 2017). The importance of teaching statistics at the graduate levels grew as the use of statistical methods in published sociological research became more complex from 1950–2000 (Raftery, 2000; Spalter-Roth, Senter, Stone, & Wood, 2010). Statistics courses are a specific type of research methods courses that emphasize quantitative methods (Babbie, 2010; Wildemuth, 2017). Debates around how, and not whether, to teach statistics to master's level students in sociology emerged as educators wanted to historically contextualize specific statistical models (Moran, 2005) and teach applied rather than theoretical statistics (Gelman, 2008). Statistical analyses in sociology publications increased from 1995 to 2017 (Schwemmer & Wieczorek, 2019).

A focus on establishing causality in theoretical arguments bolstered statistical methods training in sociology during the 1950's (Abbott, 1998). Statistics in sociology focused on simple descriptive statistics initially but grew in sophistication from 1950 to 2000 (Raftery, 2000). Social statistics courses offered to graduate students at the master's-level also teach students how to formulate theoretically-informed questions (Hardy, 2005). Statistics becomes one of the many tools students can use to analyze and present data. With respect to graduate education, sociologists accepted the growing quantification of the field (Moran, 2005; Zipp, 2005). Debates around statistics education for graduate students revolved around best practices in teaching statistics to sociology MA students (Hardy, 2005; Gelman & Nolan, 2017). Furthermore, graduate departments often require qualitative researchers to also study statistics (Zipp, 2005). Instructors of social statistics insist that students of sociology should "know the fundamentals [of statistics] in order to review and critique research and research proposals in your subfield" (Fiel, 2020).

Sociology programs expose master's-level students to varied research methods (Spalter-Roth & Van Vooren, 2009). The core skills that sociology MA students learn are research methods, statistics, and sociological theory (Spalter-Roth & Van Vooren, 2009). Statistics courses were still considered important among master's-level students uninterested in pursuing a PhD (Spalter-Roth & Van Vooren, 2009).[8] In a 2009 survey of 872 sociology master's students, the American Sociological Association's task force on master's degrees found 60% of the students enrolled in the sociology MA program considered the MA akin to a professional degree that would set them up for a better job afterwards (Spalter-Roth & Van Vooren, 2009). Among students who did not expect to pursue a PhD after the MA in sociology, 99.5% of the students took at least one research methods course (Spalter-Roth & Van Vooren, 2009).[9] And 93.5% of terminal MA students completed at least one statistics course (Spalter-Roth & Van Vooren, 2009).[10] Master's programs in sociology are not considered a bridge to PhD programs but rather a professional degree that could increase the graduate's employment options (Ballard & Daniel, 2016; Van Vooren, Spalter-Roth, & Scelza, 2010). Basic statistical analysis, measurement, and evaluation research remain among the top five most important skills that sociology MA degree-holders applied while working in a non-academic setting (Ballard & Daniel, 2016).

By comparing LIS to sociology, this study provides an empirically-grounded argument on how statistical training differs significantly between LIS and sociology master's programs. This article contributes to the debate on teaching research methods in master's-level LIS

programs and pays greater attention to statistical training within LIS. Another contribution of this study includes presenting new data regarding instructional time spent on statistics in required LIS and sociology master's-level coursework.

Study design and methods

This study set out to answer how sociology and LIS research methods training differs with respect to statistics training. To assess the differences, a dataset based on the research methods requirements of 62 ALA-accredited MLIS degree programs was constructed (ALA, 2020). The dataset included information regarding research methods course requirements, syllabi obtained, percentage of the research methods coursework focused on statistics, and whether the university also had a MA program in sociology. The curricular requirements for 62 MLIS degree programs, including the required research methods and statistics courses, were noted. The curricular requirements of the MLIS and MA in sociology programs were gathered if available on department websites and in graduate student handbooks.

Syllabi for required methods courses from LIS and sociology programs were used to assess the amount of statistics taught. Twenty six out of 36 universities responded to email requests for LIS research methods syllabi. The response rate was 72%. Syllabi included information on topics covered throughout the course. Twenty one out of the 26 syllabi included detailed week-by-week schedules. Then, the weeks of instruction devoted to statistics were noted. The content of common statistical topics covered in 21 syllabi was also tabulated. Each course's emphasis on statistical topics was represented as a percentage, which was calculated by adding the number of weeks spent on statistics divided by the total number of weeks for the course. For instance, if a course was 15 weeks long and the instructor taught statistical topics during 5 out of 15 weeks, then 33% of the course content focused on statistics. If the same course was taught over 9 weeks during the summer, then three weeks will be spent on statistics because summer courses are condensed, and students may have had to double up on assignments. Then the amount of instructional time spent on statistics will remain 33%. The author determined that weeks per semester was more appropriate than class hours per week because the percentage takes into account fully online courses and variation across universities' academic calendars when it comes to lengths of quarter and semester schedules.

From the dataset of 62 universities with ALA-accredited programs, 47 universities also had master's programs in sociology. This study focused on comparisons of sociology and LIS departments found within the same institution. This study employed statistical analysis and purposive sampling methods (Angello, 2010). Research methods and statistics course requirements for sociology MA degrees were added in the dataset. Twenty four out of 46 sociology departments responded to requests for the syllabi. The response rate was 52%. Syllabi of 60 sociology methods courses were located and analyzed since departments often taught more than one research methods course. The sociology syllabi included required research methods, qualitative analysis, and social statistics courses. The percentages for statistical course content for the sociology research methods syllabi obtained were tabulated.

The paired *t*-test involving 47 universities tested for the differences in means between LIS and sociology methods courses. A paired *t*-test was used to compare the means of required research methods courses in LIS and sociology. It was the appropriate statistical

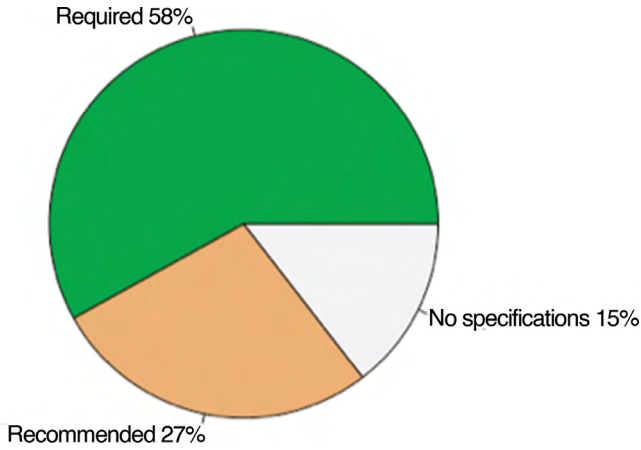

Figure 1: Breakdown of Research Methods Courses at ALA-accredited Programs (*N* = 62)
Note: The information on degree requirements was collected in July 2020; some programs may have updated their curricula.

test in this context because courses within universities were compared. An unpaired *t*-test was used to evaluate the difference in means for percentages of statistical instruction in LIS and sociology courses. This test was used because it compares independent groups with different sample sizes (McCabe & Moore, 2005). The particular test used in this study was Welch's two sample *t*-test, also known as the unequal variance *t*-test. The one-tailed Welch's *t*-test was appropriate for comparing syllabi because there were 21 LIS syllabi compared to 60 SOC syllabi. The graphs and statistical analysis included were produced using RStudio.

Findings

Methods requirements in LIS

According to department websites, the core curriculum for 36 out of 62 (58%) ALA-accredited programs mandates that students take at least one research methods course (see Figure 1). Of the 26 programs that do not require a research methods course, 15 LIS departments offer elective courses on research methods.

Most LIS departments do not teach a stand-alone statistics class. The University of Michigan (UM) is an exception. UM offers an "Introduction to Statistics and Data Analysis" (SI 544), but the course is not required for all Master of Science in Information students. SI 544 is only required for students on the Big Data Analytics track, so SI 544 was counted as an elective course.[11] On average, research methods courses in LIS focused only 19% of instructional time on statistics. 19% translates to roughly three weeks in a 15-week semester. Statistics topics covered in LIS methods courses included sampling techniques, descriptive statistics, and inferential statistics. Of the 21 syllabi that mentioned specific statistical topics being taught, LIS research methods courses often covered descriptive statistics (86%) and sampling distributions (67%) (see Table 1).

Table 1: Commonly taught statistical topics in LIS

Topic	Count	Percentage
Bibliometrics	5	24%
Correlation regression	4	19%
Descriptive statistics	18	86%
Experiments	12	57%
Frequency distribution	5	24%
Hypothesis testing	8	38%
Inferential statistics	8	38%
Sampling distributions	14	67%

Note: *N* = 21

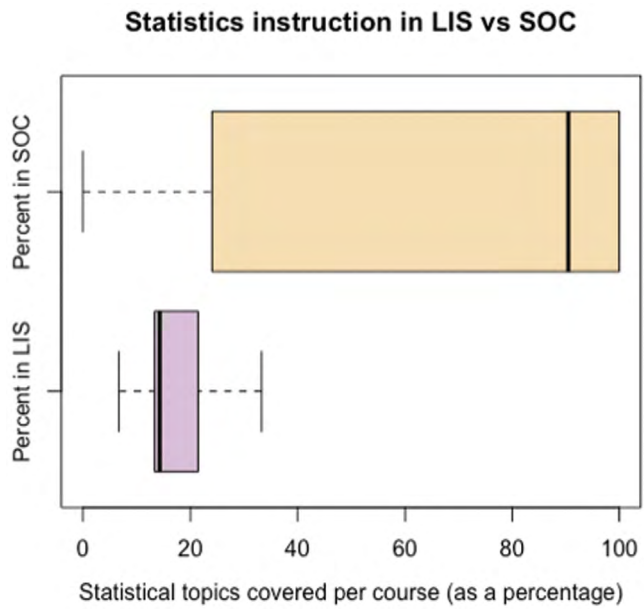

Figure 2: Percent of Instructional Time Devoted to Statistical Methods by Discipline
Note: The percent in LIS ranged from 7 to 33% and was based on 21 syllabi; the percent in SOC ranged from 0 to 100% and was based on 60 syllabi.

Comparing MLIS to MA in sociology

Out of the 62 universities with ALA-accredited MLIS programs, 47 universities offer graduate degrees in sociology. The syllabi and course descriptions of research methods courses revealed differences in statistical training between MLIS and MA in sociology programs. Forty six out of 47 (98%) sociology MA programs required at least one methods course.[12]

Table 2: Paired t-test with two-sided tail

Research methods courses per department	Mean (M)	Standard deviation (SD)	Std. Error Mean
Sociology (SOC)	2.70	0.88	0.13
Library and information sciences (LIS)	0.60	0.50	0.07

Note: From a two-sided *t*-test with the assumption, the difference of means was not zero. $N = 47$. *T*-value = 15.40, $p < .0001$. The result is significant at the $p < .0001$.

Table 3: Unpaired t-test with one-sided tail

Percent of quantitative instruction	Mean (M)	Standard deviation (SD)	Std. Error Mean
Percent quantitative in sociology	63.90	39.78	5.14
Percent quantitative in LIS	18.55	7.67	1.92

Note: From a one-sided *t*-test with the assumption, the means differed. $T = 8.27$, $p < .0001$. The result is significant at the $p < .0001$.

Sociology MA students in the sample completed around 2.7 required methods courses. According to an analysis of 60 sociology (SOC) syllabi from 24 different universities, 64% of instructional time in sociology research methods courses focused on statistical analysis compared to 19% in LIS (see Figure 2). Often departments required three methods courses, where one of the three courses was in social statistics.

Inferential statistics for differences in methods courses

T-tests demonstrated whether the means for methods courses in sociology and LIS differed significantly or not. The average number of methods courses was higher in sociology than in LIS (SOC: mean (M) = 2.70, standard deviation (SD) = 0.88; LIS: M = 0.60, SD = 0.50). The paired *t*-test resulted in $t = 15.40$, $p < .0001$, and 95% confidence interval (CI) [1.83, 2.38] (see Table 2). The *p*-value was significant at the $p < .0001$ level. The results of the *t*-test rejected the null hypothesis because the difference in means was significantly greater than zero. The difference in means was 2.1. Thus, sociology master's students took on average about 2.1 more courses than LIS students.

The unequal variances or Welch's *t*-test in a one-tailed test examined the difference in means for the percentage of statistical methods instruction in sociology and LIS. The result included $t = 8.27$, $p < .0001$, and 95% CI [34.41, 56.28]. The result was significant at the $p < .0001$ level. The null hypothesis was rejected because the means for percent of statistics instruction in LIS and sociology differed. On average, 64% of instructional time in sociology methods courses involved statistics, whereas only 19% of methods instruction in LIS focused on statistics (SOC%: M = 63.90, SD = 39.78; LIS%: M = 18.55, SD = 7.67).

The sociology mean was based on 60 syllabi and the LIS mean was based on 21 syllabi (see Table 3).

Based on the findings, MLIS students typically take one research method course and spend about 19% of instructional time on statistical methods. The most commonly covered statistical topics in LIS included descriptive statistics, experimental design, and bibliometrics. The review of syllabi revealed that sociology methods courses mainly covered topics in inferential statistics, which included multiple regression, maximum likelihood estimation, multilevel modeling, random intercept models, random coefficient models, and longitudinal or panel data analysis.

Discussion

LIS connects multiple disciplines through libraries; thus, LIS curriculum can benefit from close collaboration with other disciplines as well. Currently, most MLIS programs require only one research methods course and no course in statistics. Sociology MA programs usually mandate three research methods courses, where at least one course focuses on statistics. Like many sociology departments, LIS departments could offer an introductory statistics course to incoming graduate students similar to SI 544 at UM along with a general survey of research methods. One course in research methods may be insufficient since cursory exploration of complex topics would not adequately prepare students to conduct their own research (Kennedy & Brancolini, 2018). A sequence of courses, including an additional course in statistics, could aid students interested in research. Perhaps after more courses, LIS students would gain more confidence in their abilities to research and publish articles that use more sophisticated quantitative methods.

Training in statistics could help LIS graduates find jobs and publish as tenure-track academic librarians (Eckard, Rosener, & Scripps-Hoekstra, 2014; Goodsett & Koziura, 2016). Improving statistical methods training for librarians would broaden publication options for academic librarians (Crampsie et al., 2020; Zhang et al., 2018). Librarians could include more inferential statistics and advanced statistical techniques in future publications. More exposure to different statistical techniques would offer librarians options for types of projects to pursue and analyses to perform.

Statistical knowledge would improve information intermediation for librarians in various settings (Van Epps, 2012). In essence, adding statistics to the MLIS curricula would facilitate the work that librarians are already doing as researchers and intermediators of information. LIS professionals are adaptable and eager to learn many skills throughout their careers. Even so, updating the MLIS curriculum to reflect the increasing need for statistical literacy could give librarians invaluable skills necessary for the 21st century.

Graduate training in the 21st century should offer degree holders a multitude of job options. Top LIS programs, such as Syracuse, acknowledged the need for graduates to expand their job searches beyond libraries (Mairson, 2018). Surveys from 2016 revealed that about 83% of MLIS graduates found full-time employment post-graduation, but only about 67% of those full-time professionals were working in library-settings (Allard, 2017). Out of 284 MLIS graduates surveyed, 10% reported needing more than two years to find a professional position (Goodsett & Koziura, 2016). Based on 907 completed surveys, 6% of

recent MLIS graduates spent 7–12 months and 7% spent over a year looking for a library job (Burns & Fargo, 2019). The increased pool of qualified applicants makes job searches for entry-level positions ever more difficult for recent graduates (Eckard et al., 2014). About a third of MLIS graduates did not obtain upward mobility after the MLIS degree, and 15% of MLIS graduates were unemployed or underemployed (Burns & Fargo, 2019). To broaden the job search, students can obtain transferable skills such as statistical analysis during graduate studies. One way for MLIS students to have more exposure to statistics is for LIS departments to teach more methods courses. Another way is to encourage MLIS students to take statistics courses offered through outside departments such as sociology or education.

There are limitations to this work. The study relied on a sample of syllabi and not all universities make their syllabi publicly available. Once obtained, the topics covered according to the syllabi were tabulated into the dataset. However, the research did not uncover whether the courses were effective in teaching content to students. Future research will include surveys administered to LIS students regarding their familiarity with statistics and designing instructional modules to explain statistical concepts.

Conclusion

Even though MLIS students have options to seek out statistical training, the current degree requirements do not expose enough LIS students to statistics. Over half (58%) of the ALA-accredited MLIS programs require students to take one research methods course. Yet when students take research methods, the course instructors only devote on average 19% of instructional time on statistical methods. Within LIS methods courses, 86% of the syllabi mentioned covering descriptive statistics while only 38% of the courses discussed inferential statistics. Publications in LIS use statistical methods more now than before, but most of the statistics found in the LIS literature remain largely descriptive (Ullah & Ameen, 2018). LIS programs have encouraged students to complete small-scale projects on their own to gain hands-on research skills (Huggins, 2017; Mandel, 2017). But some foundational courses in methods and statistics could help students in developing research questions.

Sociology departments emphasize statistics more so than the LIS programs do. Sociology and LIS are comparable in that both fields publish research that use qualitative and quantitative methods. Forty six out of 47 (98%) sociology programs required a research methods course. Sociology MA students typically took three methods courses. 64% of the sociology students' methods coursework focused on statistical analysis. Knowledge of basic statistics is necessary for sociology students to read widely across academic disciplines (Creswell & Plano Clark, 2018; Fiel, 2020).

The author concludes that in comparison to sociology MA students, MLIS students study fewer statistical methods during graduate school. Currently, MLIS students in North America typically take one overview course in research methods without focusing much time on statistics. LIS programs train students to perform various tasks and to conduct research. The demand for librarians to publish and comprehend quantitative studies has increased. As research in LIS is becoming more varied, the need to teach statistics as part of the graduate curriculum has grown. Due to the increased quantification of various academic

fields, attention to statistics training in MLIS programs could benefit future information professionals, who publish and provide research support.

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Notes

1. The other 70% of the 2,412 LIS professionals surveyed consider it very important (about 30%), important (about 32%), specialized (7%), or not important (1%) (Saunders, 2019).
2. Inferential statistics allow researchers to infer or make generalizable claims regarding their findings. A random sample is needed for inferential statistical tests to be valid.
3. The study sampled 440 articles from *Library and Information Science Research* (*LISR*), *College & Research Libraries* (*C&RL*), *Journal of Documentation* (*JD*), *Information Processing & Management,* and *Journal of Academic Librarianship.* The researchers found 343 out of 440 articles to be empirical articles (Togia & Malliari, 2017). If non-empirical articles were counted as qualitative, the percentage of articles using statistics would be 60.7% (Togia & Malliari, 2017).
4. Dilevko (2007) examined *C&RL, Public Libraries* (*PL*), *Reference & User Services Quarterly* (*RUSQ*), *Library Resources & Technical Services* (*LRTS*), and *Information Technology and Libraries* (*ITL*).
5. The six journals in the study were *The Journal of the Association for Information Science and Technology* (JASIST), *Information Processing and Management* (IPM), *The Library Quarterly* (LQ), *The Journal of Information Science* (JIS), LISR, and JD (Zhang et al., 2017).
6. The totals were based on word searches in the articles' abstracts; many articles did not specify qualitative or quantitative methodological approaches directly in the abstract (Schwemmer & Wieczorek, 2019).
7. The curriculum changes in sociology highlights the increased attention to statistical skills for undergraduate and graduate-level curricula (Deckard, 2017; Sweet, McElrath, & Kain, 2014). Most sociology majors take at least one research methods course and about 80% take an additional statistics course (Sweet et al., 2014).
8. More than half of the sociology MA students are not planning to earn a PhD (Spalter-Roth & Van Vooren, 2009).
9. 30.1% of the students who did not expect to earn PhDs took one research methods course, 47.9% took two, and 21.5% took three or more courses. Among those students interested in pursuing a PhD, 33.8% took one, 43.7% took two, and 21.6% took 3 or more research methods courses (Spalter-Roth & Van Vooren, 2009).
10. 61.6% of the students who did not expect to earn PhDs took one statistics course, 25.9% took two, and 6% took three or more courses. Among students who were interested in obtaining a PhD, 55% took one, 25.2% took two, and 14.9% took three or more statistics courses (Spalter-Roth & Van Vooren, 2009).
11. Additionally, UM offers "Research Methods for Information Professionals" (SI 623), which is a recommended course for students on the Librarianship and Archival Practice track.
12. Dalhousie's sociology program was an anomaly in that the MA degree did not require any research methods courses.

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