Digital Librarian, Cybrarian, or Librarian with Specialized Skills: Who Will Staff Digital Libraries?

Linda Marion

Abstract

This exploratory study examined 250 online academic librarian employment ads posted during 2000 to determine current requirements for technologically oriented jobs. A content analysis software program was used to categorize the specific skills and characteristics listed in the ads. The results were analyzed using multivariate analysis (cluster analysis and multidimensional scaling). The results, displayed in a three-dimensional concept map, indicate 19 categories comprised of both computer related skills and behavioral characteristics that can be interpreted along three continua: (1) technical skills to people skills; (2) long-established technologies and behaviors to emerging trends; (3) technical service competencies to public service competencies. There was no identifiable "digital librarian" category.

"… what is a digital library? Conceptions differ. Approaches differ. Realizations differ." (Saracevic).[1]
"Advances in all these technologies are underway, but are not yet coordinated and targeted at the task of creating a digital librarian." (Carbonell). [2]

What specific skills does a digital librarian need to function effectively? Is a digital librarian only one who maintains a digital collection? What is the difference between a digital librarian, a systems librarian, and a reference librarian who supports web-based course delivery? Is "digital librarian" an identifiable job? The answers to these and similar questions are varied and disjunctive. It is not surprising that the definition of digital librarian is unclear given that it nests within the field of digital libraries that is rapidly evolving and inventing itself.

Although authors write about job competencies they consider essential in an automated library environment, there is no research that systematically examines the current job requirements for librarians working in that environment. Examining job ads is an established method of assessing what employers consider important in hiring new staff. While job ads do not identify the characteristics of the individuals *hired*, they do provide a picture of current trends in *desired* qualifications and skills. In other words,

Linda Marion is a doctoral student at Drexel University. E-mail: Linda.Marion@drexel.edu.

job ads represent an idealized picture of employers' wishes for new personnel, and thus, employers' vision of the future. Nesbeitt[3] found that online job boards are increasingly popular resources used by library job seekers. Presumably, the individual looking for a technologically oriented job would be particularly drawn to such a resource.

This study explored the content of online employment ads to determine the content and boundaries of librarianship. The goal of this study was to identify the skill sets currently associated with technologically oriented library jobs in order to:

• aid librarians interested in current job requirements; and

• assist managers in defining the skills needed for new personnel.

Background

Existing literature on the subject of job requirements for computer related library jobs consists of: (1) articles about technical and personal competencies, and (2) content analyses of job ads.

Librarians' job competencies

The literature on job competencies for the technologically oriented librarian consists of two major streams: those that focus on the knowledge base (professional skills) and those that focus on attributes or attitudes (personal characteristics).

Roy Tennant[4], a leading proponent of developing digital librarians, published a list of skills he considers necessary for those who create and manage digital collections and services. These skills are knowledge of:

• imaging technologies;

• optical character recognition (OCR);

• markup languages, including HTML, SGML, and XML;

• cataloging and metadata;

• indexing and DB technology;

• user interface design;

• programming;

• Web technology; and

• project management.

In a subsequent article Tennant[5] acknowledged that the rapid rate of change in technology meant that certain skills might be obsolete in a short time. To remedy this, he recommended that employers seek librarians with the following attributes or personal traits:

• capacity to learn constantly and quickly;

• flexibility;

• innate skepticism;

• propensity to take risks;

• abiding public service perspective;

• good interpersonal skills;

• skill at enabling and fostering change; and

• capacity for and desire to work independently.

Content analyses of job ads

Several longitudinal studies, tracking change over decades, have examined employment ads to assess how much and what kind of change has occurred in library positions.

Hong Xu[6] concluded that, as technology use increased in libraries between 1970 and 1990, the requirements for reference librarians and catalogers have become more similar and both groups require increased computer skills. Xu noted that there was an overall trend toward "holistic librarians" with titles and responsibilities reflecting functional definitions rather than the traditional library job categories.

Zhou[7] performed a systematic quantitative analysis of trends in demand for computer related skills for academic librarians from 1974 to 1994. He devised a thirteen-point checklist for computer related skills appearing in job ads that include knowledge of, or experience with, the following aspects:

• bibliographic utilities, such as OCLC or RLIN;

• automated library systems;

• online database searching, such as Dialog;

• microcomputer applications;

• mainframe computer applications;

• CD-ROM products;

• computer languages or programming;

• computer hardware;

• possession of a degree in computer science;

• networks, such as LAN or WAN;

• Internet searching;

• resources in electronic formats; and

• image technology or multimedia.

Zhou found that the technological job requirements changed over time as new technology appeared and was implemented. When technology was new, it was more likely to be mentioned in ads. As a particular form of technological skill, such as Internet searching, becomes commonplace, it was less likely to be mentioned. Besides devising a useful scale for assessing computer-related skills, Zhou's research supports the idea that job ads are one early indicator of innovation in the profession.

Smith and Lynch[8] used Zhou's scale and Tennant's list of behavioral characteristics in a recent investigation of the changing nature of work in academic libraries in the 1980s and 1990s. They found that required computer-related skills increased over time. Additionally, most jobs in their data set listed general, rather than specific, computer skills; for example, "working with resources in electronic formats" or "knowledge of computerized systems". Mention of behavioral traits, such as "creativity", "enthusiasm", and "flexibility" also increased over time. The researchers discovered that "combination" jobs that shift from traditional specialist to more complex functionalist positions rose in their sample.

Questions Guiding This Study

(1) What specific technical skills and behavioral characteristics are listed in current online job ads for professional librarians?

(2) Can a subset of these ads be classified as digital librarian jobs?

Methods

This exploratory study examined 250 online academic librarian employment ads posted during 2000 to determine current requirements for technologically oriented jobs. The ads were selected from the ACRL online job board, *C&RL News,* and LIS programs' job boards. Two criteria determined inclusion in the study. First, because this study focuses on job requirements for professional librarians, the job had to require an ALA approved Master's degree. Second, the ads needed multiple mentions of "electronic", "virtual", "technology", or more specific terms potentially relevant to computer related librarian skills and qualifications. In other words, in order to capture the most technologically oriented jobs, an ad needed to include more than a single reference to "knowledge of computers" or a similar general phrase.

The author conducted a pilot study in May 2000. The original data set included ads encompassing public, school, and special library jobs as well as academic jobs. Preliminary analysis of the data revealed that public and school library jobs and senior administrative positions in all settings overwhelmingly mentioned only very general technologically related requirements, such as "familiarity with computers" or "knowledge of automated library systems". Special library jobs presented a different picture than academic positions and will be analyzed separately. Therefore, this paper reports on an analysis of academic library jobs.

A content analysis software program, WordStat[9], was used to categorize the specific skills and characteristics listed in the online ads for academic libraries. The coding categories were derived from a combination of sources: (1)

Table 1. Content Analysis Categories

Category Label	Examples of Dictionary Terms
Automated Library System	Integrated library system, Innovative Interfaces
Bibliographic Utilities	OCLC, RLIN. MARC
Collegial	Collaborative, Interested in partnerships, consultative
Computer Hardware	PC, network, microcomputer, Mac
Distance Education	Asynchronous education, online education
Diversity	Work effectively with multicultural staff, faculty, and/or students
E-Library	Digital library, electronic library, virtual library
Emerging Trends	Newly emerging, newly evolving
Energetic	Enthusiastic, highly motivated
Environment	Rapidly changing or complex environment
E-Resources	Electronic journals, databases, digital, online, computerized resources
Independent	Self-directed, self-managed
Innovative	Creative, visionary, interested in leading-edge
Interpersonal Skills	Communication, oral, verbal, written presentation, organization skills
Leadership	Leader, leads, leading
Public Service	Commitment to; consumer, user, or client focused
Programming Languages	Java, XML, Perl, SQL
Teamwork	Work effectively as part of a team
Website	Creation, organization, maintenance, development, support of web pages and web site

a frequency count of the most commonly mentioned relevant terms in the ads; (2) Zhou's thirteen-point checklist of computer-related skills; and (3) Tennant's lists of personal attributes and technical skills. (See Table 1 for a list of the categories).

Katherine W. McCain[10, 11] used examination of classification terms, such as headings or descriptors, for structural analysis of a knowledge domain. In order to examine the structure of the employment market for librarian jobs, the terms analyzed in this study are those derived from the content analysis of the job ads in the data. The frequency counts of category labels were converted into a matrix of similarity (correlation) values, which indicates the relative similarity or dissimilarity of pairs of terms. The use of correlations rather than raw frequency counts has the effect of compensating for large differences in frequency counts for commonly occurring terms. While large frequency counts are themselves a measure of influence, the present research is concerned with the structure of the job market; thus, a measure of co-occurrence similarity provides more useful information. The result is a "co-occurrence pro-file" of category labels that forms the basis for further data analysis. This technique is related to cocitation analysis. (See McCain[12] for a detailed explanation of cocitation and co-word techniques).

The structure of the correlation matrix was explored using two multivariate techniques: cluster analysis (SimStat[13], a statistical analysis program) to identify clusters of terms with similar co-occurrence patterns, and multidimensional scaling (SimStat) to produce a three-dimensional display of the data.

Results
Cluster Analysis
The hierarchical agglomerative clustering approach used in this study begins by joining two terms whose patterns are the most similar according to the distance criterion chosen in this study—average linkage. Subsequent terms are joined to existing clusters and the clusters are combined until one cluster is formed that encompasses the entire set of terms. The results are displayed in a dendrogram, in which (moving from left to right) the more similar the terms are, the sooner they are clustered and the shorter

Figure 1. Hierarchical Cluster Analysis
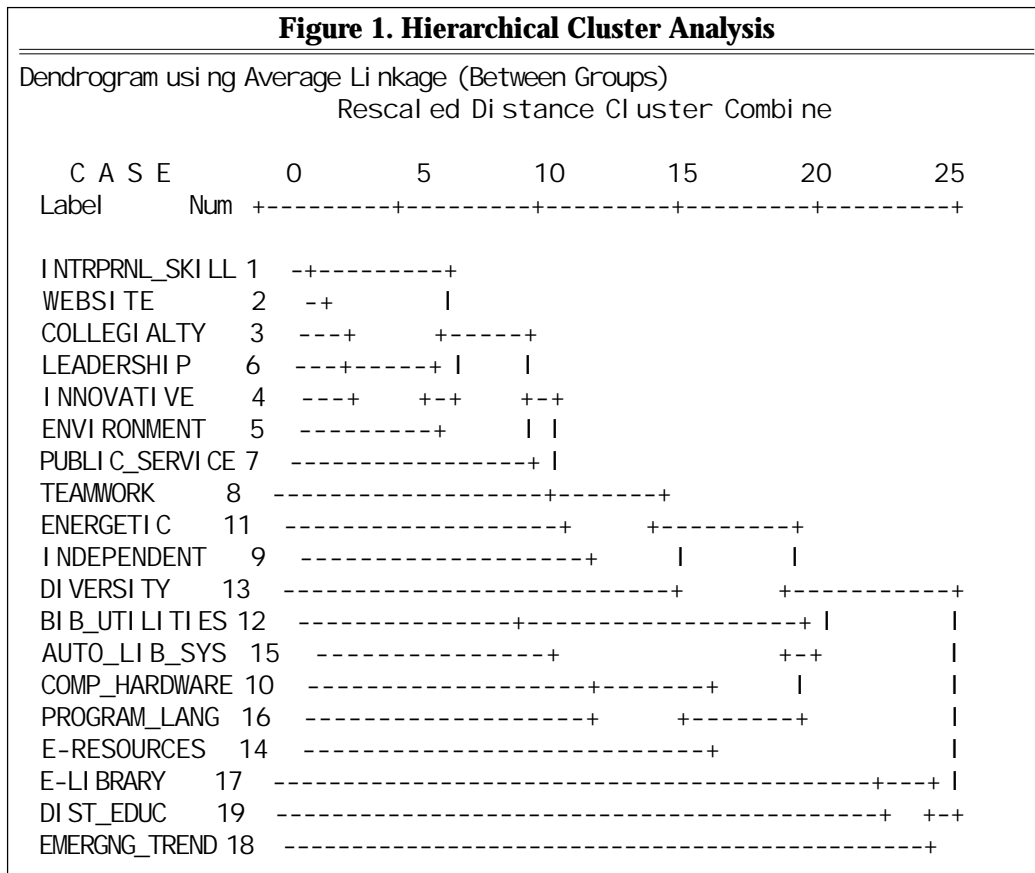
the spatial distance between the linkages. (See figure 1.) There is no "best" number of clusters. The vertical line on the dendrogram partitions the set of terms into the number of clusters that most clearly informs the discussion.

At the six-cluster level, three coherent groups emerge. Three terms ultimately link to the rest of the cluster but remain separate at this level. The largest cluster represents a core of 11 skills and characteristics in the set of employment ads. Most of the terms refer to behavioral and personality characteristics and only one category refers to computer related skills. The computer-related category, Website, refers to creation, organization, and maintenance of websites and web pages. The second cluster to emerge consists of the most technically oriented skills found in the ads. This group includes knowledge of computer languages, computer hardware and networking, and electronic resources. The third cluster consists of Bibliographic Utilities and Automated Library Systems. Finally, Distance Education, knowledge of Emerging Trends, and Electronic (or digital) Libraries are isolates.

Multidimensional Scaling

Multidimensioal scaling (MDS) uses the same proximity (correlation) matrix as cluster analysis to study the underlying structure of the data. Often used jointly with cluster analysis, MDS produces a two- or three-dimensional map in which similarity of the ads' co-occurrence patterns are represented by spatial proximity on the map. The MDS map (figure 2) contains a three-dimensional map for the category set (RSQ = .81, stress = .24). The cluster boundaries are those shown in Figure 1 (six cluster level); the three isolated terms are boxed to distinguish them. The map shows the superimposed category clusters from the dendrogram as loops around groups of terms. The axes of the map are interpreted by examining the term and cluster placement. Categories with many links to others tend to be centrally located on the map while those that are weakly linked or with a few focused ties are at the periphery.

Three-dimensional maps are very difficult to represent adequately on a two- dimensional page, hence only two axes are display here. The axes represent underlying dimensions in the data set. The horizontal axis (X) represents a varia-

Figure 2. Academic Library Job Skills
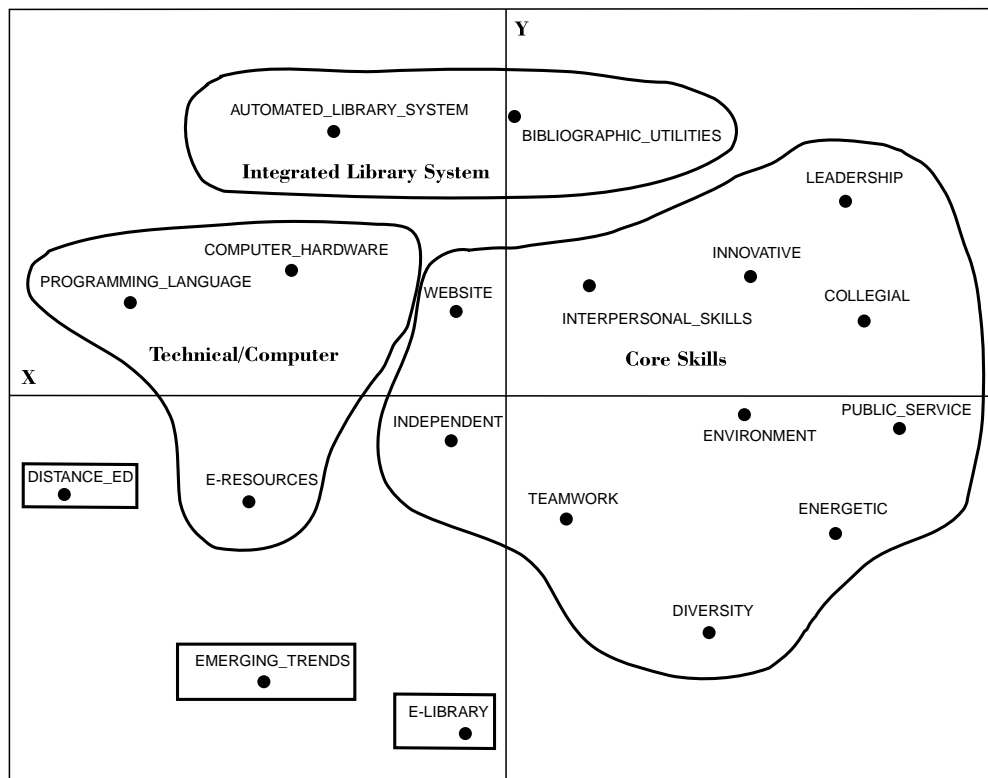
tion of an oft-noted phenomenon on cocitation maps; that is, a continuum from technical domain knowledge on the far left to applications of domain knowledge on the far right (see McCain[14]). In this case, the categories are arranged on a continuum from the technically oriented focus on programming languages on the left to a public service focus on the right. The Y-axis represents a time dimension from longer established skills at the top of the map to the newest categories of skills at the bottom. Thus, Bibliographic Utilities, one of the earliest automated areas in the academic library, appears at the top. Emerging Trends, Diversity, and Electronic Libraries, representing the newest skill categories found in the job ads, are placed at the bottom. Diversity, representing the ability to work effectively with diverse multicultural staff and patrons, reflects the relatively recent prominence of this personality characteristic. The Z-axis (not shown) displays a continuum from technical service to public service positions in the academic library.

The most centrally located categories on the map are Website, Interpersonal Skills, Independent, and Teamwork. These terms refer respectively to the creation and maintenance of web pages and web sites; possession of excellent interpersonal, communication, and organizational skills; the ability to perform independent creative work; and, the ability to work effectively as part of a team.

Discussion

The results of this study provide a coherent picture of the job skills, both technical and behavioral, currently deemed desirable by prospective employers. The results also illustrate the usefulness of using content analysis and co-word analysis methods for establishing a baseline for exploring the field of librarianship.

This study provides support for Tennant's[15] focus on behavioral characteristics and some of his recommendations for computer related skills as well as for Smith and Lynch's[16] findings. The latter researchers noted that behavioral characteristics, such as "excellent communication skills" and "leadership" became increasingly visible during the 1980s and 1990s. In the 2000 job ads these types of phrases occurred very frequently, with Interpersonal Skills the most frequently occurring category overall. Skills like Teamwork and Collegiality reflect a new organizational focus in libraries that echoes the business management literature. Experience and acceptance of Diversity was an oft-mentioned characteristic, representing the newest and welcome addition to necessary qualifications for employment.

Although the Core cluster of skills included only one computer related category, Website, terms related to web pages and web sites occurred with the second highest frequency exceeded only by Interpersonal Skills. Clearly, the academic library world has wholeheartedly accepted the necessity for working with the online environment. Employers are clearly eager to hire librarians with web skills. A representative job ad would indicate that employers are looking for an interpersonally skilled individual, knowledgeable about web applications, able to work effectively both independently and as part of a team.

The Technical cluster most closely resembles some skills associated with Systems Librarians. As Tennant[17] and Zhou[18] indicated, computer savvy skills are in demand, especially for those who are knowledgeable about networking and computer languages, such as Java and Perl.

The results of this study did not provide evidence for an identifiable digital librarian job category. Rather the evidence points to an increasingly and a rapidly changing automated library environment. The job titles vary a great deal, often with little resemblance to traditional job titles. Xu[19] noted a trend toward "holistic librarians" with titles and responsibilities reflecting functional definitions rather than traditional library job categories. Smith and Lynch[20] found a similar trend they labeled "combination" jobs. Worth watching will be the newly emerging areas of distance education and digital libraries. Possibly, these topics, together with increasing emphasis on digital resources, will lead to the emergence of a definitive digital librarian. These findings of this study argue for the ongoing monitoring of job skills appearing in job ads as a useful perspective on current trends in librarianship.

Notes

1. Tefko Saracevic, "Preface. Digital libraries: Interdisciplinary concepts, challenges, and opportunities". In T. Aparac et al., eds. *Proceedings of the 3rd CoLIS Conference, Zagreb*, 1999.

2. Jaime Carbonell, "Digital librarians: Beyond the digital book stack," *IEEE Expert* 11, no.3 (1996): 13.

3. Sarah Nesbeitt, "Trends in Internet-based library recruitment," *Internet Reference Services Quarterly*, 4, no.2 (1999) and <http://webhost.bridgew.edu/snesbitt/recruit_article.htm> (May 8, 2000).

4. Roy Tennant, "The most important management decision: Hiring staff for the new millennium," *Library Journal Digital*, February 15, 1998, <http://www.ljdigital.com/articles/infotech/digitallibraries/19980215_2276.a> (April 25, 2000).

5.   Roy Tennant, "Skills for the new millennium," *Library Journal Digital*, January 1, 1999. <http://www.ljdigital.com/articles/infotech/digitallibraries/19990101_4121.a> (April 25, 2000).

6.   Hong Xu, "The impact of automation on job requirements and qualifications for catalogers and reference librarians in academic libraries," *Library Resources & Technical Services* 40, no. 1 (1996): 9–31.

7.   Yuan Zhou, "Analysis of trends in demand for computer-related skills for academic librarians from 1974 to 1994," *College & Research Libraries* 57, no. 3 (1996): 259–72.

8.   Kimberly R. Smith and Beverley B. Lynch, "The changing nature of work in academic libraries," *Racing Toward Tomorrow, ACRL Ninth National Conference, Detroit, Michigan, April 8-11, 1999*, <http://www.ala.org/acrl/lynch.pdf> (March 25, 2000).

9.   WordStat, Provalis Research, 2000, <http:// www.simstat. com> (April 25, 2000).

10.   Katherine W. McCain, "The structure of biotechnology R&D," *Scientometrics* 32, no. 2 (1995): 153–75.

11.   Katherine W. McCain, "R&D themes in information science: A preliminary co-descriptor analysis." In M. Koenig and A. Bookstein (eds.), *Proceedings of the Fifth Biennial Conference of the International Society for Scientometrics and Informetrics, Rosary College, Pine Forest, IL, June 7–10, 1995*, (Medford, N.J.: Learned Information, 1995), 275–82.

12.   Katherine W. McCain, "Mapping authors in intellectual space: A technical overview," *Journal of the American Society for Information Science* 41, no. 6 (1990): 433–43.

13.   SimStat, Provalis Research, 2000, <http:// www.simstat. com> (April 25, 2000).

14.   Katherine W. McCain, "Islands in the stream: Mapping the fisheries and aquatic sciences literatures," *Fisheries* 19, no. 10 (1994): 20–27.

15.   Tennant, 1998, 1999.

16.   Smith and Lynch.

17.   Tennant 1999.

18.   Zhou, 261.

19.   Xu, 271.

20.   Smith and Lynch, 6.