

Cataloging Professionals in the Digital Environment: A Content Analysis of Job Descriptions

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This study assesses the current state of responsibilities and skill sets required of cataloging professionals. It identifies emerging roles and competencies focusing on the digital environment and relates these to the established knowledge of traditional cataloging standards and practices. We conducted a content analysis of 349 job descriptions advertised in AutoCAT in 2005–2006. Multivariate techniques of cluster and multidimensional-scaling analyses were applied to the data. Analysis of job titles, required and preferred qualifications/skills, and responsibilities lends perspective to the roles that cataloging professionals play in the digital environment. Technological advances increasingly demand knowledge and skills related to electronic resource management, metadata creation, and computer and Web applications. Emerging knowledge and skill sets are increasingly being integrated into the core technical aspects of cataloging such as bibliographic and authority control and integrated library-system management. Management of cataloging functions is also in high demand. The results of the study provide insight on current and future curriculum design of library and information-science programs.

Introduction

The application of information technology in libraries has engendered great challenges in the cataloging profession. Khurshid points out three major developments in library automation that have greatly affected cataloging professionals (Khurshid, 2003):

1. The development of the Machine Readable Cataloging (MARC) format by the Library of Congress in the early 1960s;
2. The introduction of microcomputer and optical disc technologies in the early to mid- 1980s;
3. The emergence of Internet technologies, markup languages and non-MARC standards in the 1990s.

Each of these developments has led to changes in the job characteristics of cataloging professionals. The appearance

of titles such as “electronic resources librarian,” “metadata librarian,” and “metadata analyst” to some extent reflects the influence of Internet technologies, the third development cited by Khurshid. In recent years, the rapidly increasing number of digital repositories has further influenced the nature of the cataloging profession.

This study assesses the current state of the responsibilities and skill sets demanded from cataloging professionals. It identifies emerging roles and competencies centering on the digital environment and relates these to the established knowledge of traditional cataloging standards and practices. In order to achieve this we conducted a comprehensive content analysis of 349 job descriptions that were advertised on the AutoCAT listserv from January 2005 through December 2006. The research questions guiding this study are

1. What is the current state of job responsibilities and skill sets demanded from cataloging professionals?
2. What are the emerging roles and skill sets of cataloging professionals geared toward the digital environment?
3. How do the emerging knowledge and skill sets relate to the knowledge of traditional cataloging standards and practices?

Literature Review

In light of significant changes in the cataloging profession, researchers over the last decade have studied a variety of issues and trends in relation to the roles and competencies of professional catalogers. Researchers employed two primary methods: (a) content analysis of job descriptions; and (b) surveys of practicing professionals. Below is a summary of relevant studies.

Content Analyses of Job Descriptions

Analysis of job advertisements has been used in a number of studies assessing the skills and competencies that employers desire in new hires (Albitz, 2002; Kennan, Cole, Willard, Marion, & Wilson, 2006; Lynch & Smith, 2001; Marion, 2001; Marion, Kennan, Willard, & Wilson, 2005). Analyses of job advertisements offer a view of employers' preferences

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for new hires and expectations of their future needs. Several research studies employed analyses of job descriptions for catalogers.

With the aim of investigating academic cataloging professionals, Hosoi analyzed 124 job advertisements for academic cataloging positions posted in *College & Research Libraries News* and *American Libraries* in 1999 (Hosoi, 2000). Job titles, degree and experience requirements, skills, and responsibilities were analyzed. The study identified a variety of job titles, such as catalog librarian, special formats/electronic resource cataloger, serials cataloger/librarian, head of cataloging, and head of technical services. Skills for cataloging special formats, foreign-language materials, electronic resources, and serials as well as online catalog database maintenance were highly sought after. Hosoi also highlighted the importance of managerial skills such as formulating policies and work flow, supervision, and staff training. She noted the frequency of other library functions including HyperText Markup Language (HTML)/Web page design, reference, collection development, bibliographic instruction, binding, preservation, and interlibrary loan service.

Chaudhry and Komathi (2001) examined how technological advances demand new requirements and skills from cataloging professionals. Identifying 1995 as the date that the Internet made an impact on cataloging jobs, the researchers divided 131 job descriptions sampled from *American Libraries* into two periods: 1990–1994 (traditional environment) and 1995–1999 (electronic environment) and compared the expectations of employers for job candidates in the two periods. Chaudhry and Komathi reviewed the job descriptions in terms of eight categories: knowledge of cataloging tools and resources, knowledge of automated cataloging systems, knowledge of Internet/digital systems, computing skills, communication skills, managerial skills, relevant work experience, and educational requirements. Results of the study suggest that traditional cataloging knowledge and tools are still relevant in the electronic environment even as job responsibilities have been expanding into the electronic environment.

Kwasik (2002) conducted a study of the skills needed for serials librarians in an electronic environment based on 90 job descriptions posted in *SERIALST*, *American Libraries*, *College & Research Libraries News*, and *The Chronicle of Higher Education* between 1999 and 2001. According to her results, knowledge of cataloging and classification standards such as MARC, Anglo-American Cataloging Rules (AACR), and Library of Congress Subject Headings (LCSH), is the most frequently named required qualification. Additionally, experience with bibliographic utilities, such as the Online Computer Library Center (OCLC) and integrated library systems, are also requisite skills for serials librarian positions. Kwasik found that frequently named desired skills are knowledge of the Dublin Core (DC) metadata scheme, markup language, and Web design. The study also identified new job titles for serials librarians such as “electronic resources cataloger,” “digital resources librarian” and “electronic serials librarian.” Kwasik (p. 36) points out that “cataloging

print and electronic resources, markup language, Dublin Core, and management are going to be the areas in which serials librarians will need further training”.

In order to investigate the management of electronic resources in academic libraries Albitz collected position descriptions drawn from *College & Research Libraries News* from January 1996 through December 2001 (Albitz, 2002). The position descriptions are analyzed in the areas of the reporting structures, responsibilities, and professional experience requirements. Content analysis shows that positions dealing with electronic resources are associated with both technical and public services in terms of the reporting structures. Most academic libraries require candidates to have a maximum of three years of experience. Albitz noted only generic descriptions of job responsibilities, such as coordination of electronic resources and reference and bibliographic instruction.

Khurshid (2003) examined the changes in job requirements and qualifications of catalogers stemming from the development of Internet technologies and library automation. She analyzed job descriptions published in *American Libraries* and *College & Research Libraries News* from 2000 to 2001 in terms of position titles, degree requirements, and required qualifications and skills. The study identified a series of emerging titles such as electronic/digital resources librarian, metadata librarian, and metadata analyst as well as new skills directly related to electronic resource management.

More recently, Hall-Ellis published two studies that investigated the cataloging profession (Hall-Ellis, 2005, 2006). The goal of the first study (Hall-Ellis, 2005) was to obtain information about employer expectations regarding academic preparation, technical skills, and competencies for entry-level cataloging professionals. She analyzed 151 entry-level cataloging librarian position descriptions posted in *American Libraries*, *AutoCAT* and the *Colorado State Library Jobline* from September 2000 through August 2003. Data from the job descriptions were analyzed based on the following categories: employer description, academic preparation, theoretical basis for organization, related technical services or bibliographic control tasks, assignments outside the cataloging domain, and communication and work-based relationships. Results showed that both broad theoretical knowledge and practical experience of cataloging, knowledge of automated library systems, and computer skills are all highly sought after by employers.

Following the same approach, in the second study, Hall-Ellis (2006) analyzed 89 managerial and supervisory cataloging position announcements posted in *American Libraries*, *AutoCAT* and the *Colorado State Library Jobline* from September 2000 through August 2004 (Hall-Ellis, 2006). Results demonstrated that there are higher expectations for individuals desiring managerial positions in terms of academic preparation and professional experience. Candidates for managerial positions are expected to possess a second graduate degree, strong publication record, substantial experience with technical services, supervision and training experience as well as theoretical knowledge,

a practicum in cataloging, and effective communication and collaboration skills.

Surveys of Employed Professionals

Unlike content analyses of job advertisements, which offer a prospective view of employers' expectations for new hires, surveys of employed professionals offer information about who is actually hired. A few studies investigated the changing role of cataloging professionals by employing a survey method. The data in these surveys is more recent than in the previously described studies.

Anthony and Garbs (2005) conducted a web survey to study recruitment of cataloging professionals at academic libraries. The researchers sought data on various aspects of the hiring process, such as the number of applicants, the number of applicants meeting the minimum criteria, and the length of time it took and difficulties encountered in filling the positions. The results of this survey suggested that recruitment of academic cataloging professionals is increasingly difficult. The supply is short of professional-level catalogers who are equipped with skills dealing with traditional cataloging resources and dealing with emerging digital resources.

Leysen and Boydston (2005) surveyed the advertisements of cataloging and technical service departments in 100 academic libraries of the Association of Research Libraries in 2003. They collected data on the number of professional catalogers, the allocated amount of time for cataloging, the recruitment situation, and the future role of professional catalogers. The results of the study, based on 60 responses, show that the number of professional catalogers is decreasing, and that there are difficulties in recruiting professional catalogers. An important finding is that the primary responsibility of catalogers has shifted from cataloging to the management of cataloging activities including system integration and vendor product implementation. New skills are needed to adapt to technological advances and the electronic environment; in particular, respondents anticipate that metadata creation will be critical to catalogers in the future.

Glasser (2007) assessed some of the major changes in technical services departments in the past 15 to 20 years. In reporting on the changing roles and responsibilities of the cataloging profession from the late 1980s onward, she points out the following main factors powering change: technological advances, automation, the growth of electronic resources, increased user demands on library services, and shrinking budgets. In line with the study by Leysen and Boydston (2005), Glasser (p. 43) points out that "the greatest change in staff roles has been the trend of delegating tasks . . . while responsibilities formerly solely within the realm of management are allocated to professional catalog librarians." She reports that cataloging professionals are expected to not only master standards and tools for traditional cataloging but also be equipped with a variety of skills and knowledge encompassing management, computer use, oral and written communication, teaching, and

metadata standards. Behavioral characteristics such as flexibility, awareness of trends, and teamwork are also highly sought from cataloging professionals.

In summary, studies conducted over the last decade report a variety of issues and trends facing the cataloging profession. In light of rapid changes in the profession, however, data from 5–10 years ago argues for an investigation of the current state of the roles, qualifications, and skill sets demanded of cataloging professionals, and the need to identify roles and competencies engendered by the emergence of the digital environment. Furthermore, there is a need to examine the way in which these emerging skill sets relate to the knowledge of traditional cataloging standards and practices.

Methodology

Analysis of job descriptions is an established approach to examining the changing roles of cataloging professionals. In line with this, we collected notices of job openings posted on the *AutoCAT* listserv between January 2005 and December 2006. *AutoCAT*, which serves as a major communication channel among cataloging professionals on issues concerning information organization, cataloging, and classification, is also a major channel for announcing position openings. We gathered 349 distinct job descriptions (161 from 2005 and 188 from 2006) posted during the two-year period (see sample job descriptions in Appendix A). The descriptions were posted mostly by academic libraries with lesser numbers posted by school, public, special, and other libraries. In this study we do not differentiate the descriptions posted by different types of libraries.

We conducted a content analysis of the position announcements in order to learn the responsibilities and skill sets in demand in the cataloging profession. The procedures used for data analysis follow those in previous studies by Marion (Marion, 2001; Marion et al., 2005; Marion & McCain, 2001), which were adapted from the well-established methods of cotermin and cocitation analysis (McCain, 1990). The content-analysis software package *SimStat/Wordstat* (Provalis, 2006) was used to identify the frequency with which specific categories of technical skills and responsibilities appeared in the advertisements. Term co-occurrence matrices were computed; multivariate techniques of cluster analysis and multidimensional scaling (MDS) were used to explore relationships among the categories.

We initially conducted a pilot study to gain snapshot of the job descriptions' structure. We manually coded 55 job descriptions and identified the most frequently occurring categories: (a) job titles; (b) background information of the institution; (c) job responsibilities; (d) required qualifications/skills; (e) preferred qualifications/skills; and (f) other information such as contact address and deadline. In this study we report results solely on job titles, job responsibilities, and required and preferred qualifications/skills.

All job descriptions were entered into the *SimStat/Wordstat* software. A critical step is creating a categorization dictionary or categories of terms that constitute the

basis for analysis of the text. A categorization dictionary was built for each of the following: responsibilities, required qualifications/skills, and preferred qualifications/skills. We created the categorization dictionaries from a combination of sources including (a) counts of the most frequently mentioned content-bearing terms in the advertisements; (b) a literature review that yielded skills and responsibilities identified by previous researchers; and (c) our own knowledge of the cataloging profession.

The initial output is frequency counts of the terms. The frequency with which terms appear is an indication of importance in the data set akin to a measure of overall popularity, but the relationships among terms provides a nuanced and richer understanding of the data similar to learning the membership of a group. Thus, if several terms tend to appear together in advertisements we can identify a set of skills/responsibilities. In order to ascertain the overall structure and relationships among the categories in the areas of required and preferred qualifications/skill sets, co-occurrence matrices were created. These are derived from the number of job descriptions in which a pair of categories co-occurs.

The frequency counts of categories were converted to a matrix of co-occurrence similarity (correlation) values. The similarity values indicate the relative similarity or dissimilarity of occurrence for pairs of terms. The use of correlations, rather than raw frequency counts, has the effect of compensating for large differences in counts for commonly occurring terms. While large frequency counts are themselves a measure of importance, the present research is concerned with the structure of the cataloging profession; therefore, a measure of co-occurrence similarity provides more useful information. The result is a “co-occurrence profile” for each category term. The profiles are assembled in a matrix and explored further. This method follows the well-established protocols for cocitation and cword analysis (McCain, 1990).

The structure of the correlation matrix was explored using two multivariate techniques: cluster analysis to identify terms with similar co-occurrence patterns, and MDS to produce a visual graph of the data. Both techniques are part of the SimStat/WordStat software package (Provalis, 2006). Using several methods to explore the data enables us to gain a more complete picture of the underlying structure. The MDS method is particularly effective for this study in that it allows us to visualize and capture the relationships of categories of skill sets; it enables us to examine the way in which emerging skill sets relate to the established knowledge and skills of traditional cataloging standards and practices.

In order to identify clusters of categories with similar co-occurrence patterns and to generate a map representing the underlying dimensions of these categories, the proximity matrix was fed into two multivariate statistical analyses: hierarchical clustering analysis and multidimensional scaling. The cluster analysis is based on the pattern similarity (correlations) of the categories in the dictionary. One output of a cluster analysis is a dendrogram, which is a graphical display of the clustering process. The hierarchical agglomerative clustering approach used in this research begins by

joining two terms with the most similar patterns according to the distance criterion. Subsequent terms are joined to existing clusters and the clusters are combined until one large cluster results that encompass the entire set of terms.

Multidimensional scaling uses the same similarity (correlation) matrix as cluster analysis to study the underlying structure of the data. Often used jointly with cluster analysis, multidimensional scaling produces a two- or three-dimensional graph or “map” in which the co-occurrence patterns of the terms are represented visually on the map. Thus, two terms with similar co-occurrence patterns are represented as lying close to each other on the map while terms with dissimilar patterns are placed far from each other. The axes represent the underlying dimensions or structure of the data set.

Results

In the following subsections, we will present the results of our analysis of the 349 job descriptions in the data set. Results are presented in four areas:

- Job titles
- Required qualifications and skills
- Preferred qualifications and skills
- Responsibilities

Job Titles

The job-title analysis shows a widely dispersed spectrum of titles. Table 1 presents the 11 most frequently occurring job titles in data set.

The data included a very wide variety of individual job titles. The most frequently occurring titles accounted for 182 job descriptions, or just over half of the data. The most frequently appearing category of job titles, found in 104 job descriptions, is Cataloger/Cataloging Librarian/Catalog Librarian. Interestingly, this traditional title appears even though skills and knowledge related to digital resources appear in these position descriptions (discussed below).

TABLE 1. Most frequently occurring job titles in 349 advertisements.

Job title	Frequency	Percentage
Cataloger/Cataloging librarian/ Catalog librarian	104	29.8
Special formats and materials cataloger (i.e., rare book cataloger, music cataloger, and AV cataloger)	21	6.0
Serials & e-resources cataloger	13	3.7
Head, cataloging	9	2.6
Metadata librarian	9	2.6
Catalog & metadata librarian	6	1.7
Cataloging coordinator	6	1.7
Head, cataloging & metadata services	4	1.2
Serials cataloging coordinator	4	1.2
Project cataloger	3	0.9
Serials librarian	3	0.9
Total	182	52.2

The second most frequently appearing job titles (21 job descriptions) concern special formats and materials, including Rare Book Cataloger, Music Cataloger, and Audiovisual Format Cataloger, demonstrating the importance of this knowledge and skill set. Serials cataloging professionals are also in high demand. Job titles related to serials cataloging, such as Serials and E-Resources Cataloger, Serials Cataloging Coordinator, and Serials Librarian appear in 20 job descriptions. As electronic serials have become a major information source, the job of Serials and E-Resources Cataloger is indicative of the need for catalogers dealing with the increasingly important environment of electronic serials.

It is noteworthy that managerial-level positions appear to be in high demand in the cataloging professions. The most frequently used specific job titles for supervisory or managerial level positions (Head, Cataloging; Head, Cataloging and Metadata Service; Serials Cataloging Coordinator; Cataloging Coordinator) appear in 23 job descriptions. However, the figure becomes much higher when job titles containing managerial-level terms such as Head, Coordinator, Manager, Director, and Supervisor are included in the entire data set. The total of all titles referring to a supervisory or managerial position in a job description is 76.

The analysis of job titles evinces a picture of the role of cataloging professionals in the emerging areas related to metadata creation and electronic resource management. Metadata Librarian, Catalog and Metadata Librarian, Head of Cataloging and Metadata Services, and E-Resources Cataloger are examples of these positions. Other titles alluding to digital-resource developments are listed in Appendix B. Titles reflecting developments in the digital environment

appear in 58 (16%) job descriptions of the entire data set. The majority of these emerging job titles contain terms such as *metadata*, *electronic*, *digital resources*, and *digital*, which demonstrates cataloging professionals' responsibilities in relation to metadata creation and management for developing digital repositories.

Required Qualifications and Skills

As stated earlier, a categorization dictionary was built for areas of responsibilities and required and preferred skills. Table 2 displays the category labels along with examples of terms appearing in the position announcements that are assigned to the category, as well as the percentage of announcements in which the terms appeared in the data set. The sample terms and phrases in the second column are illustrative and not exhaustive.

The most frequently stated skill is interpersonal communication, mentioned in three quarters of the advertisements. This finding is similar to Chaudhry and Komathi's (2001) study which found 77.86% of job descriptions required excellent communication and interpersonal skills. The importance of interpersonal skills is also found in studies focusing on other types of library job descriptions (Kwasik, 2002; Lynch & Smith, 2001; Marion, 2001; White, 1999).

The importance of interpersonal communication skills is also reflected in the draft statement of the American Library Association (ALA) Task Force on Core Competencies, which was created by the ALA Executive Board in 1999 (ALA Task Force on Core Competencies, 2002). The draft statement contains 45 competencies in seven major categories: organization of knowledge resources,

TABLE 2. Categories of required qualifications/skills and characteristics.

Category label	Sample terms and phrases	Total percentage
Interpersonal communication skills	Collaborate, cooperate, interact, collegial, communication, oral and written	75.6%
Cataloging standards	AACR, MARC, DDC, LCC, LCSH, LCRI, MESH, CONSER	69.9%
Bibliographic utilities	OCLC, RLIN, CONNEXION	54.4%
Management	Coordinate, leadership, head, guide, organizational, supervise	46.1%
Integrated library system (ILS)	Automated library system, integrated library system, Horizon, Innovative Interfaces, INNOPAC, Unicorn	33.5%
Computer skills	Hardware, software, office applications, word processing, spreadsheet, Windows	32.1%
Flexibility	Changing environment, dynamic environment	31.5%
Electronic resources	Databases, digital collections, online resources, CD-ROM	30.4%
Individual initiative	Independent, self-motivated	28.7%
Trends	Current trends, emerging trends, evolving	28.4%
Problem solving	Question answering, quality control, evaluation, resource person	28.1%
Foreign languages	Asian languages, Western European languages, Spanish, German, French	26.4%
Metadata	Dublin Core, EAD, MODS, TEI, VRA Core	23.5%
Authority control	Authority records, NACO, SACO	23.5%
Public services	Clients, customer service, patrons, user, service-oriented	18.1%
Attention to detail	Detail-oriented, meticulous, accuracy	17.2%
Web knowledge	FTP, Network, WWW, HTML, SGML, XML	16.3%
Project management	Project planning, implement projects, complex projects	12.9%
Professional commitment	Professional development, professional growth, professionally active, research skills, scholarship	11.7%
Staff training	Teaching, training	10.6%
Creativity	Innovation, inventive	6.0%

information and knowledge, connecting people to ideas, facilitating learning, management, technology competencies, and research. Interpersonal communication skills are grouped in the area of management. It seems that interpersonal communication skills are fundamental for cataloging professionals.

A number of other categories relate to personal and behavioral characteristics. Followed by managerial skills, flexibility and awareness of current and emerging trends occur 31.5% and 28.4% respectively as required qualifications/skills. Additional categories related to personal characteristics include problem solving (28.1%), individual initiative (28.7%), attention to detail (17.2%), professional commitment (11.7%), creativity (6%), and public services (18.1%). This suggests that employers believe it is critical for cataloging professionals to be able to adapt to a rapidly changing environment and to demonstrate an interest in the continuing professional development necessary to keep abreast of emerging technologies (see also ALA Task Force on Core Competencies, 2002).

In addition to the importance of interpersonal skills related to a rapidly changing environment, employers also expect cataloging professionals to possess traditional cataloging skills and knowledge. Knowledge of traditional cataloging and classification standards remain relevant in the digital environment. Following interpersonal communication skills, nearly 70% of job descriptions explicitly require knowledge and skills of traditional cataloging and classification standards such as the Anglo-American Cataloguing Rules (AACR), Dewey Decimal Classification (DDC), Library of Congress Classification (LCC), Library of Congress Subject Headings (LCSH), Library of Congress Rule Interpretations (LCRI), and Machine Readable Cataloging (MARC). Bibliographic utilities (e.g., OCLC), integrated library systems (ILS), and authority control appear very frequently in job descriptions.

As discussed regarding job titles (above) managerial skills (46.1%) are important. This is likely connected to the high demand for cataloging positions at the managerial level. Project management (12.9%) and staff training (10.6%) are categories related to supervisory or managerial aspects of a position. As stated earlier, ALA Task Force delineates managerial skills as a main component of core competencies (ALA Task Force on Core Competencies, 2002).

Skills and knowledge generally related to the digital environment, such as computer skills, Web knowledge, electronic resources, and metadata stand out as important requirements for catalogers. The frequency with which these terms appear confirms the observation regarding job titles (see Appendix B). The digital environment requires that cataloging professionals are skilled in applications necessary for managing electronic resources and digital repositories.

The ALA Task Force posits knowledge and skills for organizing resources through a broad range of organizing methods such as cataloging, indexing, and metadata as a librarian's unique competency. The task force also delineates technology competencies related to handling electronic information as a core area of competency. Such technology competencies directly encompass the above identified skills and knowledge—computer skills, Web knowledge, electronic resources, and metadata (ALA Task Force on Core Competencies, 2002).

The structure of the similarity matrix was explored using two multivariate techniques: cluster analysis, to identify clusters of categories with similar patterns; and multidimensional scaling (ALSCAL, nonmetric option) to produce two- and three-dimensional graphical displays of the data. Both analyses can be performed using the Simstat/WordStat software. Hierarchical agglomerative cluster analysis was applied to the similarity matrix. One output of cluster analysis is a dendrogram, a graphical display (Figure 1). The list of 21 categories of required job skills forms seven coherent clusters.

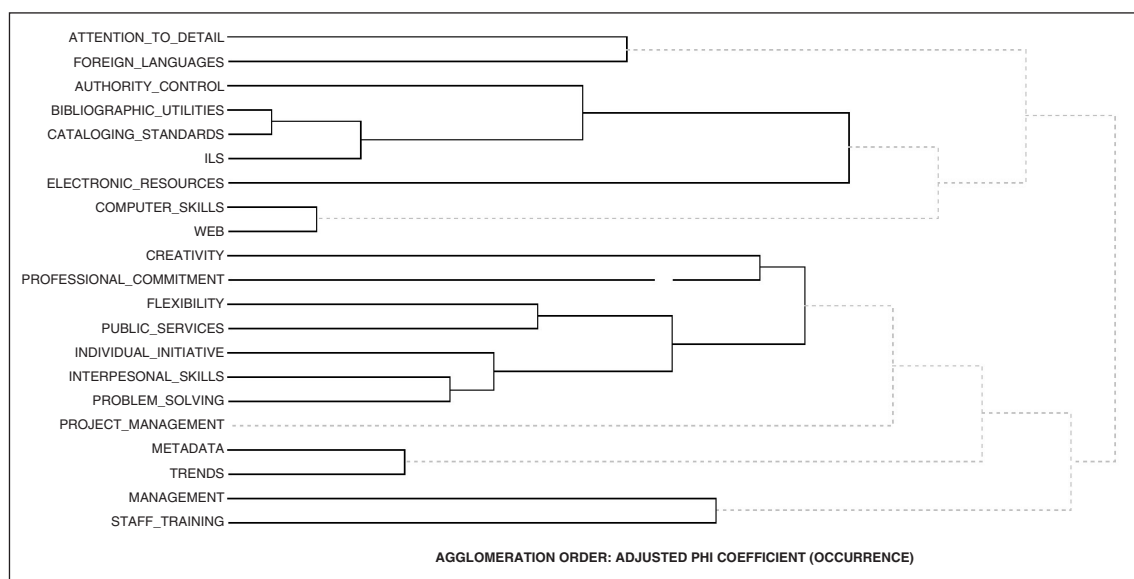


FIG. 1. Dendrogram of required qualifications and skills.

The agglomerative hierarchical cluster analysis first combines the two categories with the greatest pattern of similarity (lowest distance) into a cluster. As shown in Figure 1, Bibliographic Utilities and Cataloging Standards are joined first. Computer Skills and Web are clustered next as an independent cluster. Metadata and Trends are soon joined as an independent cluster after ILS is added to Bibliographic Utilities and Cataloging Standards. The early clusters are perhaps not surprising. The group of Bibliographic Utilities, Cataloging Standards, and ILS represent traditional cataloging skills and knowledge. Likewise, Computer Skills and Web represent a logical pairing

The combination of Metadata and Trends forms a cluster. As Caplan pointed out, there is no limit to the type or number of resources that can be described by metadata (Caplan, 2003). A metadata scheme can be developed or proposed for any area that shows a demand for electronic- and digital-resource discovery and sharing. The use of these metadata schemes is not limited by language or country boundaries either. In this sense, new metadata schemes may keep emerging, while the existing schemes may keep evolving. Thus, the cluster reflects the close relationship between current and emerging Trends and Metadata in the digital environment.

The largest cluster contains seven categories of personal and behavioral characteristics: Professional Commitment, Creativity, Flexibility, Public Service, Individual Initiative, Interpersonal Skills, and Problem Solving. The second largest cluster represents the technical aspect of cataloging: Authority Control, Bibliographic Utilities, Cataloging Standards, ILS, and Electronic Resources. Electronic Resources is part of this cluster, which encompasses technical aspects of

traditional cataloging, although this category was added late in the clustering process. It would be interesting to revisit the data in a few years to see if that category is added earlier in the process, indicating that it is more firmly embedded in the skill set along with more long-standing technical cataloging skills.

Two small clusters, each with two categories, emerged from the cluster analysis: (a) Management and Staff Training; (b) Foreign Languages and Attention to Detail. Finally, Project Management is an isolate and is not joined with any other category at this solution level.

The similarity matrix of required skills and knowledge was also analyzed with multidimensional scaling (MDS.) Figure 2 displays the MDS results. The optimal number of dimensions is three ($R^2 = 0.82$, Stress = 0.24); however, due to the difficulty of presenting three dimensions on paper only the first two dimensions are displayed here. Loops drawn around groups of terms represent clusters from the cluster analysis.

The MDS map graphically displays the underlying dimensions of the categories of required knowledge/skills. The vertical or y-axis points to the technical versus nontechnical aspects of the job descriptions in the data set. Along the vertical axis (Y), the categories Bibliographic Utilities, Cataloging Standards, and ILS located at the lower part of the map concern the technical aspects of cataloging, while the categories located at the upper part of the map (Problem Solving, Individual Initiative, Interpersonal Skills, Flexibility, and Public Services) are associated with personal characteristics.

The horizontal or x-axis appears to represent a continuum of skills/knowledge required for traditional cataloging (Authority Control, Bibliographic Utilities, and Cataloging

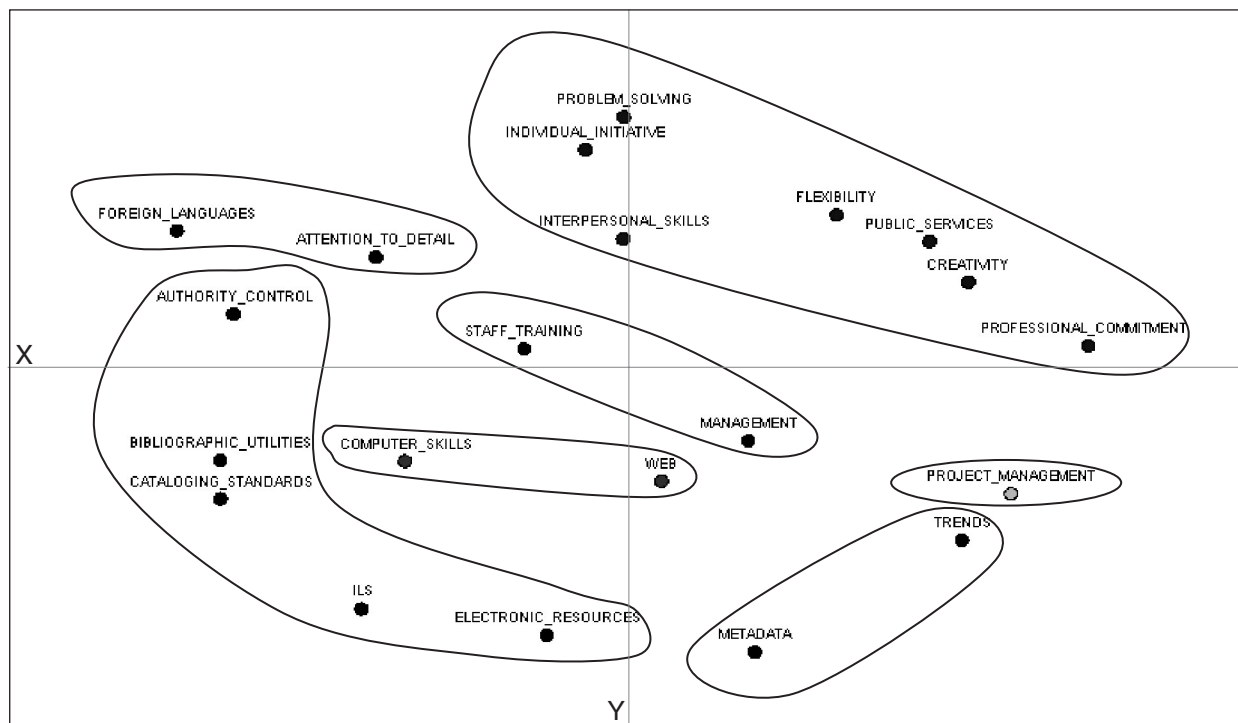


FIG. 2. MDS map of required qualifications and skills.

Standards) on the left side of the map to those skills/knowledge applicable to the digital environment (Trends, Metadata, Project Management, Web, Computer Skills, and Electronic Resources) on the center right. Thus, the digital to nondigital dimension seems to underlie the *x*-axis. The largest cluster, drawn mostly from the category of non-technical aspects (Creativity, Flexibility, Public Services, Individual Initiative, Interpersonal Skills, Problem Solving, and Professional Commitment) is located in the upper part of the map. The cluster comprising the technical aspects of cataloging drawn from the categories Authority Control, Bibliographic Utilities, Cataloging Standards, ILS, and Electronic Resources is placed on the lower left part of the map. We noted above that Electronic Resources was added late to the cluster of technical cataloging knowledge and skills. The MDS map shows Electronic Resources placed close to Metadata indicating similarity. Additionally, the small clusters encompassing the categories Metadata-Trends and Web-Computer Skills related to the emerging skills of cataloging professionals are adjacent to this second largest cluster. This may indicate that knowledge and skills related to the digital environment are increasingly being integrated into the core technical aspects of cataloging.

The cluster composed of Management and Staff Training appears at the center of the map. Terms appearing in the center of a map are those with ties to many other terms, which is not surprising because as discussed above aspects of management and supervision appear in many job descriptions. The placement of Project Management close to Trends is interesting. Project Management is an isolate on the dendrogram.

Preferred Qualifications and Skills

The categorization dictionary of the preferred qualifications/skills is illustrated in Table 3.

As shown, managing an integrated library system (40.7%) forms the most frequently mentioned preferred qualification/skill, followed by foreign languages (24.4%) and bibliographic utilities (22.9%). Conversely, cataloging standards (15.8%), authority control (10.0%), management (15.5%), and interpersonal skills (8.6%) appear with a much lower percentage. We suspect that this is owing to the fact that these categories tend to form the core knowledge and competencies expected from cataloging professionals; accordingly, as shown in Table 2, the categories occur with much higher demand in the required qualifications/skills: cataloging standards (69.9%), authority control (23.5%), management (46.1%), and interpersonal skills (75.6%).

Skills and knowledge generally related to the digital environment, such as electronic resources (18.1%), metadata (12.3%), Web knowledge (9.5%), computer skills (8.6%) and awareness of trends (8.3%) appear in the categories of preferred qualifications/skills with a lower percentage vis-à-vis those categories in the required qualifications/skills (see Table 2). Collation of the demand of these categories across different types of libraries may provide an insight into the disparity of occurrence of these categories in required and preferred qualification and skills; that is, the demand for the above-mentioned skills and knowledge may manifest disparately in academic versus public libraries.

In the same way as the required qualifications/skills, the hierarchical agglomerative cluster analysis is applied to the category set of preferred qualifications/skills. Figure 3 shows the dendrogram of the cluster analysis.

As shown, Electronic Resources and Metadata show the lowest distance and are joined first; this indicates the close relation between these two categories. This cluster forms a bigger cluster by joining with the category Web Knowledge. It is interesting to note that Computer Skills and Trends form an independent cluster.

TABLE 3. Categories of preferred qualifications and skills.

Category label	Terms and phrases	Total number	Total percentage
Integrated library system	Automated library systems, Horizon, VOYAGER, ALEPH, Innovative Interfaces, INNOPAC, Unicorn	142	40.7%
Foreign languages	Asian languages, Western European languages, Spanish, German, French	85	24.4%
Bibliographic utilities	OCLC, RLIN, CONNEXION	80	22.9%
Electronic resources	Databases, digital collections, online resources, ERMS	63	18.1%
Cataloging standards	AACR, MARC, DDC, LCC, LCSH, LCRI, MESH, CONSER	55	15.8%
Management	Lead, guide, supervise, oversee, budget	54	15.5%
Metadata	Dublin Core, EAD, METS, MODS, OAI, TEI, VRA Core	43	12.3%
Authority control	Authority Records, NACO, SACO	35	10.0%
Web knowledge	Internet, markup languages, HTML, SGML, OPEN URL	33	9.5%
Computer skills	Hardware, PC, software, office applications, word processing, spreadsheet	30	8.6%
Interpersonal skills	Collaborate, cooperate, interact, collegial, team, oral and written communication	30	8.6%
Trends	Current trends, emerging trends	29	8.3%
Staff training	Teaching, training	23	6.6%
Project management	Project planning, project development	22	6.3%
Public services	Clients, customer service, user, reference service	16	4.6%
Flexibility	Changing environment, dynamic environment	14	4.0%

Note. The terms and phrases in the second column are some examples and are not exhaustive.

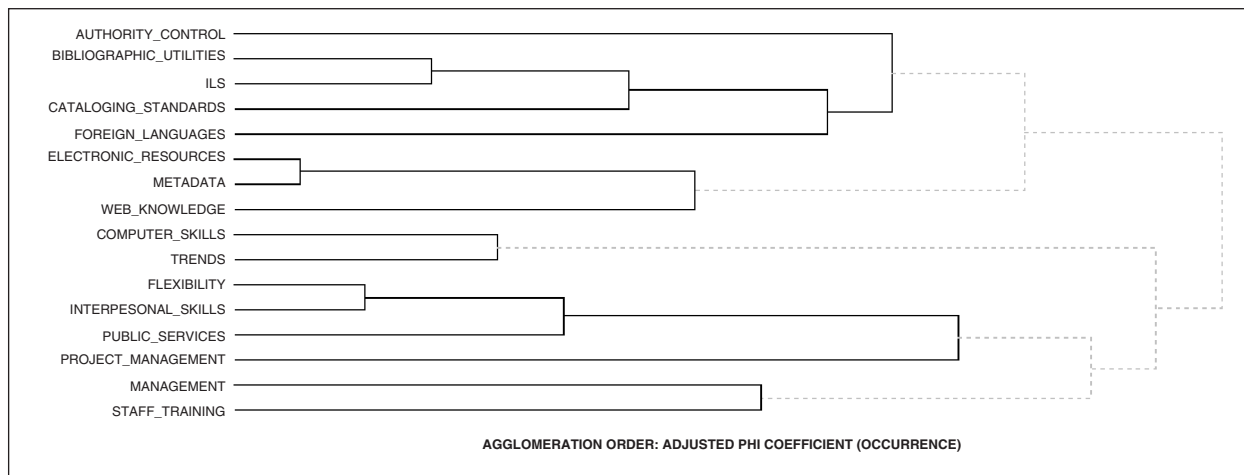


FIG. 3. Dendrogram of preferred qualifications and skills.

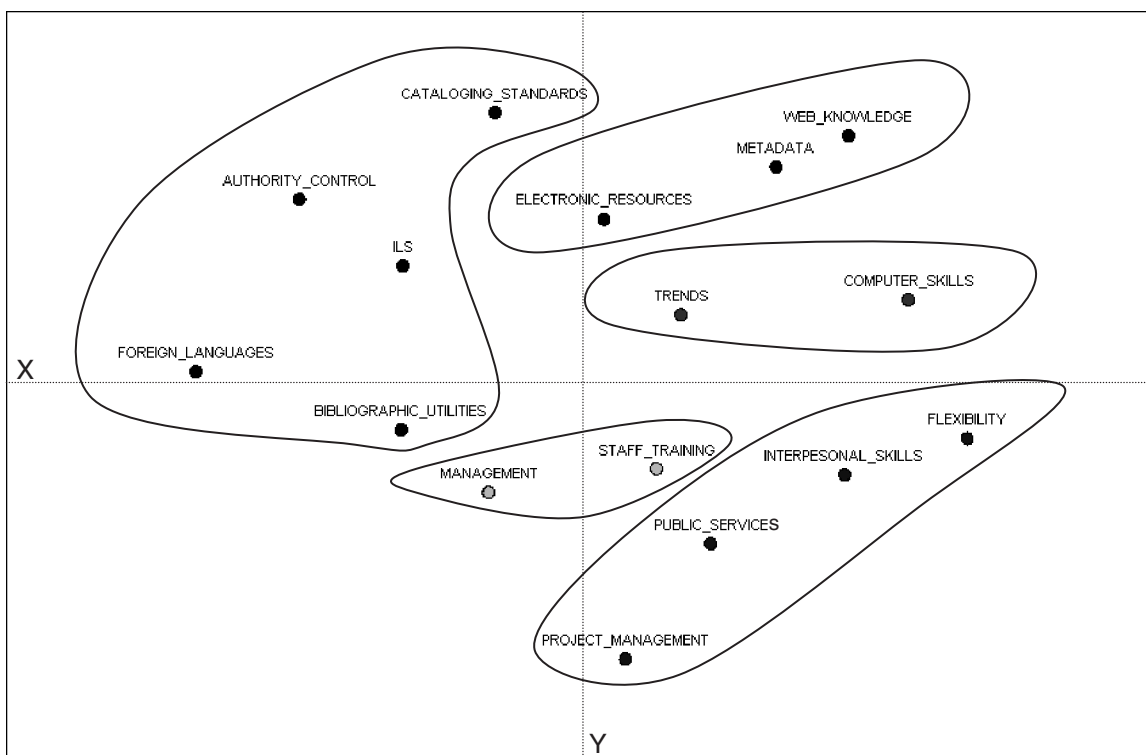


FIG. 4. MDS map of preferred qualifications and skills.

The largest cluster is composed of the categories of Authority Control, Bibliographic Utilities, ILS, Cataloging Standards, and Foreign Languages. These appear to be the traditionally known core skills and knowledge for cataloging tasks. The second largest cluster is first built by Flexibility and Interpersonal Skills, followed by the Public Services. These categories are associated with behavioral and non-technical aspects of cataloging. It is interesting to note that this large cluster joins with the category of Project Management. The categories Management and Staff Training form an independent cluster.

The pattern of relations among these categories is illustrated in the MDS map in Figure 4. The optimal number of dimensions is three ($R^2 = 0.89$, Stress = 0.21); due to the difficulty of presenting 3D-MDS on paper, the first two dimensions are displayed here.

The traditionally known core cataloging skills encompassing the categories Authority Control, Bibliographic Utilities, ILS, Cataloging Standards, and Foreign Languages are located at the upper left part of the map. On the other hand, the cluster characterizing personal and behavioral aspects is located at the lower right part of the map. The clusters

related to the digital environment, including the categories of Electronic Resources, Metadata, and Web Knowledge, and the categories Computer Skills and Trends, are adjacent to each other and to the cluster characterizing the core technical aspects of cataloging. The cluster encompassing the categories of Management and Staff Training is located around the middle of the map.

Along the *y*-axis, it is clear that the categories at the upper part of the map are related to the technical aspects of cataloging; on the other hand, the categories at the lower and central parts of the map are mostly associated with managerial and behavioral characteristics. Thus, technical versus non-technical dimension underlies the structure of the categories along the *y*-axis.

On the other hand, along the *x*-axis, the categories reflecting the digital environment, such as Web Knowledge, Metadata, Computer Skills, Electronic Resources, and Trends, are all located on the right side of the map. Categories encompassing knowledge and skills geared toward traditional cataloging, such as Authority Control, Bibliographic Utilities, ILS, Cataloging Standards, and Foreign Languages are located at the left part of the map. In this sense, technological advancement and digital environment underlie the structure of the *x*-axis. The technology dimension identified in this map along the *x*-axis indicates emerging knowledge and skills

related to digital resources, metadata creation, and computer and Web applications.

Responsibilities

In the same way as in required and preferred qualifications and skills, the most frequently occurring terms and phrases describing responsibilities were used for building the categorization dictionary in Table 4.

As shown, the principal responsibility expected from cataloging professionals concerns general cataloging (60.5%). This comprises activities such as copy and original cataloging and descriptive and subject cataloging. Ability in utilization of cataloging standards and tools such as AACR, MARC, LCC, and LCSH is also included in this principal responsibility (i.e., general cataloging).

Special cataloging (26.9%), nonprint cataloging (25.8%) and serial management (25.2%) are also seen as major duties, in addition to general cataloging. Special cataloging deals with special materials and subject areas such as archives, government documents, maps, and rare books. Nonprint cataloging includes microforms, music scores, audiovisual formats such as sound and video recordings, and image resources such as photographs. Serial management concerns serial cataloging.

TABLE 4. Categories of responsibilities.

Category label	Terms and phrases	Total number	Total percentage
General cataloging	Copy cataloging, descriptive cataloging, original cataloging, subject analysis	211	60.5%
Management	Administer, coordinate, lead, head, monitor, guide, oversee, supervise, policy making, strategic planning, hire	199	57.0%
Problem solving	Question answering, quality control, evaluation, Resource person	171	49.0%
Bibliographic control and utilities	Bibliographic access, OCLC, RLIN	169	48.4%
Authority control	Authority records, authority files, name authority, NACO, SACO	145	41.5%
Electronic resource management	Digital collections, digital resources, digital objects, electronic formats, electronic journals, online resources	141	40.4%
Awareness of trends	Current trends, emerging, evolving, new, up-to-date, maintain currency	126	36.1%
Staff training	Train staff	109	31.2%
Metadata	Metadata services, metadata schemes, Dublin Core, EAD, MODS, TEI	95	27.2%
Special cataloging	Archival, government documents, maps, rare books	94	26.9%
Nonprint cataloging	Media, audiovisual, microform, music scores, photographs, sound recordings, video recordings	90	25.8%
Serial management	Serial publications, serial cataloging	88	25.2%
Integrated library system	Automated library system, integrated library system, Horizon, Sirsi, Innovative Interfaces, INNOPAC	77	22.1%
Collection development/management	Acquisition, collection management	73	20.9%
Public services	Customers, patrons, users, circulation	62	17.8%
Database management	Database administration, database maintenance, database quality control	60	17.2%
Committee participation	Serves on committees, library committees, university committees, task force	58	16.6%
Reference	Reference desk, research assistance	57	16.3%
Professional development	Conferences, professional organizations, professional development, research and publication, scholarly communication	55	15.8%
Digital library projects	Digital initiatives, digital projects, digitization projects	49	14.0%
Department liaison	Liaison	39	11.2%
Instruction	Bibliographic instruction, teach	29	8.3%
Web development	Web page, Web site, Web presence	25	7.2%

Note. The terms and phrases in the second column are some examples and are not exhaustive.

Bibliographic control and utilities (48.4%) and authority control (41.5%) also constitute a high percentage of the responsibilities of the cataloging profession. These categories include responsibilities in handling bibliographic utilities such as OCLC for bibliographic access. The critical role of authority control has been evidenced through information sharing of traditional bibliographic collections. Accordingly, competency in handling authority files and ability in using standards for authority control also rate high in terms of areas of responsibility.

As shown in earlier sections, managing an integrated library system is listed as a required and preferred skill (33.5% required skill; 40.7% preferred skill); however, ILS occurs with a much lower percentage (22.1%) in the area of job responsibilities. We suspect that this is owing to the fact that the management of an integrated library system is not clearly stated as a job responsibility in a noticeable number of job descriptions.

Management (57%) is a responsibility in high demand. This comprises activities such as administration, coordination, overseeing, supervision, hiring, policy making, and strategic planning. Staff training (31.2%) occurs separately from management. In relation to managerial responsibility, problem-solving activities (49%) such as question answering, acting as a resource person, and reviewing cataloging quality are also in high demand.

The rapid expansion of digitization and digital repositories is reflected in the job responsibilities expected of cataloging professionals. Analysis of job descriptions shows that electronic resources management (40.4%) has become one of the core duties for cataloging professionals. Metadata creation (27.2%) appears as a major role played by the cataloging profession. The responsibility of metadata creation includes ability in using a variety of major types of metadata schemes such as Dublin Core, Encoded Archival Description (EAD), Metadata Object Description Schema (MODS), Visual Resources Association (VRA), and Text Encoding Initiative (TEI). Metadata creation is a vital component for resource description and discovery in digital environment.

A digital library project (14%) separately occurs as a critical role for the cataloging profession. It appears as digitization projects and/or digital-library initiatives. It is noteworthy that awareness of trends (36.1%) occurs as one of the job responsibilities. All of these responsibilities (i.e., electronic resources management, metadata creation, digital library, awareness of trends) characterize the changing roles of cataloging professional in this digital environment.

In addition to the above-mentioned responsibilities, there are a wide variety of duties expected from cataloging professions, including collection development and management (20.9%), public services (17.8%), database management (17.2%), committee participation (16.6%), professional development (15.8), reference service (16.3%), instruction (8.3%), flexibility (10.6%), department liaison (11.2%), and Web development (7.2%). Such a wide variety of duties is consistent with the findings of Hall-Ellis's study (2005).

Conclusion

Analysis of job descriptions in terms of job titles, required and preferred qualifications and skills, and responsibilities lends perspective to the roles that cataloging professionals play in the digital environment. Results of the comprehensive content analysis of job descriptions indicate that the advancement of technology has affected every aspect of the cataloging profession: job titles, competencies/skills, and responsibilities. A group of new job titles has emerged; titles such as metadata librarian, electronic resource cataloger, and digital resources cataloger reflect the emerging role of the cataloging profession in the development of digital collections and repositories.

Multivariate techniques of cluster and multidimensional scaling (MDS) analyses of the categories of required and preferred qualifications/skills give a picture of the emerging skill sets sought of prospective cataloging professionals. Technological advances increasingly demand of cataloging professionals knowledge and skills related to electronic resource management, metadata creation, and computer and Web applications. As illustrated in the MDS maps of the required and preferred qualifications and skill sets (see Figures 2 and 4), it is particularly noteworthy that the above-mentioned emerging knowledge and skill sets are increasingly being integrated into the knowledge and skills of traditional cataloging practices. Awareness of current and evolving trends in relation to the development of information technologies and metadata standards demands close attention from those involved in the cataloging profession.

In the realm of responsibilities, the following areas are seen as emergent: metadata creation, electronic resource management, database maintenance, digital library project management, and Web development. These responsibilities are also being gradually incorporated into established traditional cataloging tasks and practices such as general descriptive and subject cataloging, nonprint cataloging, bibliographic and authority control, and ILS management.

Results of the job-description analysis show that a total of 76 job descriptions (21.78%) concern managerial-level positions; however, the managerial aspects of cataloging such as hiring, policy making, and planning constitute 57% of indicated job responsibilities. This figure becomes even higher when combining responsibilities of problem solving, constituting 49% by itself. Problem-solving activities include tasks closely related to management such as evaluation, quality control, and question answering. It should be noted that the managerial-level positions were not separated from the entire data set ($n = 349$) during analysis. The high demand of the managerial aspects of cataloging from nonmanagerial level positions (e.g., entry-level positions) is deserving of further study.

The emerging job titles, skill sets, and responsibilities reflect the changing role of cataloging professionals in the digital environment. However, there is no indication that competencies and skills in relation to the cataloging of traditional resources have become less in demand. Traditional

job titles such as cataloger and cataloging librarian are still dominantly used in job announcements. Knowledge of bibliographic utilities, cataloging standards, and ILS form one of the largest clusters in the MDS map. Behavioral and non-technical aspects of cataloging such as interpersonal skills, public services, and flexibility are also highly sought after in the cataloging profession; accordingly, this forms another large cluster in the MDS maps.

The results of this study provide insight into the current and future curriculum design of library and information science (LIS) programs. Findings show that there is a need to provide students with the knowledge and complex skills centering on the organization and provision of access mechanisms for digital resources. Knowledge and skill sets related to electronic resource management, metadata creation, and computer and Web applications need to be reflected in LIS curricula. Additionally, managerial aspects of cataloging, especially in relation to the planning of digital projects, also need to be taken into consideration vis-à-vis LIS education. Cataloging and metadata education merits an in-depth study drawn from a wide variety of data sources (see Hsieh-Yee, 2002).

There are limitations to the findings of this study. We collected job announcements for cataloging professionals only from the AutoCAT listserv and only for a limited two-year time period, between January 2005 and December 2006. Even though the AutoCAT listserv is a major channel for job announcements for the metadata profession, there are other sources of job announcements for professionals in the field. Thus, the findings of the study need to be further validated by utilizing job announcements from a larger pool of data sources and with a longer and more recent time period.

Another limitation of the study stems from the fact that we did not differentiate job descriptions posted by different types of libraries. The majority of job announcements for this study came from academic libraries; the findings of this study might have been affected by the high distribution of position announcements from academic libraries. Therefore, the findings should be further substantiated by comparing different types of libraries and institutions. These limitations of the study create ground for further studies on the current state of the roles and competencies demanded of cataloging professionals.

Acknowledgment

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Appendix A: Job Description Samples

Sample 1

Date: Tue, 24 Jan 2006 22:08:39 -0600
Reply-To: AUTOCAT <AUTOCAT@LISTSERV.BUFFALO.EDU>
Sender: AUTOCAT <AUTOCAT@LISTSERV.BUFFALO.EDU>
From: [de-identified]
Subject: Cataloger; Laramie, Wyoming

The University of Wyoming Libraries is seeking applicants for the position of Cataloger.

RESPONSIBILITIES: Perform original and complex copy cataloging and authority control on physical and digital resources in a variety of formats and subjects. Participate in ongoing database maintenance and other departmental projects as needed. Under the guidance of the libraries' NACO coordinator create name authority records for submission to NACO. As a member of the library faculty, pursue an active and ongoing program of professional development, scholarship, and service. Report to the Head of Technical Services.

REQUIRED QUALIFICATIONS: MLS from an ALA-accredited institution. Knowledge of cataloging standards and practices. Knowledge of LCC, LCSH, USMARC, metadata, AACR2R, OCLC, authority control, bibliographic maintenance, and integrated library system functionality. Excellent interpersonal, oral and written communication skills. Strong problem solving abilities.

PREFERRED QUALIFICATIONS: Two years professional cataloging experience. OCLC experience, preferably the Connexion client. Experience with integrated library systems, preferably Voyager. Academic library experience. NACO experience. Reading ability of a foreign language sufficient to catalog.

APPLICATION AND SALARY: Review of applications will begin on February 27th, 2006. The minimum salary is \$36,000, dependent on qualifications and experience; 12-month appointment, 22 days vacation; sick leave, group health insurance, state and TIAA-CREF retirement plans, no state income tax. Please direct questions to Ms. Birgit Burke at 307-766-3279 or e-mail burek@uwyo.edu.

ENVIRONMENT: The University of Wyoming is the only accredited four-year institution of higher education in the state and is a Carnegie Extensive Doctoral/Research University. The University's library collections total 1.5 million volumes. Laramie, a city of 27,000 located 130 miles northwest of Denver, offers a reasonable cost of living and the friendly, relaxed atmosphere of a small community combined with the cultural and social activities associated with the University. Laramie is located in an area of national forest, clean air, wide-open spaces, and excellent summer and winter recreation sites. Additional information about the Libraries and the University of Wyoming may be accessed through its Web site: www.uwyo.edu.

Sample 2

Date: Sun, 27 Feb 2005 22:27:18 -0600
Reply-To: AUTOCAT <AUTOCAT@LISTSERV.BUFFALO.EDU>
Sender: AUTOCAT <AUTOCAT@LISTSERV.BUFFALO.EDU>
From: [de-identified]
Subject: Cat. & Meta. Management, Cullowhee, North Carolina

Cataloging and Metadata Management Librarian Hunter Library, Western Carolina University

Extended Search: Hunter Library seeks an energetic, intellectually curious, and innovative librarian with strong analytical and problem-solving skills to join its service-oriented staff. This position will report to the Head of Cataloging and Acquisitions but will work in close collaboration with other units in the library. This librarian will provide leadership in developing new ways to approach the description, organization, and access to information resources at Western Carolina University.

Position responsibilities include: Linking library database resources to the library catalog and each other using Web-Bridge tables, tables within the federated search engine, and other tools. Enhancing access to resources of special interest to the WCU community, such as local history resources. Providing access to existing collections that are not fully cataloged, such as the WCU Archives and Manuscripts collections, maps, and other contemplated resources. Ongoing development of metadata standards and best practices

Such access may be provided through the catalog or through other metadata schemes.

Required: A Master's of Library Science from an ALA-accredited school; extensive knowledge of AACR2, LCRI, MARC, LCSH, and LC classification and knowledge of OCLC or another bibliographic utility; knowledge of metadata standards and schemes, such as the Dublin Core; knowledge of integrated library systems; effective written and oral communication skills.

Preferred: Two years of professional or paraprofessional cataloging experience in an academic library; serials and/or media cataloging experience; knowledge of Open URL technologies and federated search engines; experience with regular expressions and/or programming; knowledge of reference databases, including their administrative modules; familiarity with Innovative Interfaces ILS.

Please submit letter of application, resume and names and telephone numbers of three references to: Chair, Cataloging and Metadata Management Librarian Search Committee, Hunter Library, Western Carolina University, Cullowhee, NC 28723. Review of applications will begin immediately and will continue until the position is filled. For full consideration, applications should be received by March 28, 2005.

Minimum salary is \$37,000. Salary and rank commensurate with qualifications. This is a twelve-month, tenure-track

position with a generous 24 days of vacation leave annually. Choice of retirement plans includes Fidelity, Lincoln, TIAA-CREF, VALIC, or the North Carolina State retirement system.

Hunter Library shares an online catalog with two other university libraries that comprise the Western North Carolina Library Network. Western Carolina University (www.wcu.edu <<http://www.wcu.edu>>) is one of the 16 senior

institutions of the University of North Carolina and is an affirmative action, equal opportunity employer. Western is a fast growing, regional comprehensive university with approximately 8,400 students. The university is located in one of the major recreational areas in the Southeast, situated between the Great Smoky Mountains and the Blue Ridge Mountains. While in a rural setting, the university is only one hour from Asheville and three hours from Atlanta and Charlotte.

Appendix B: Job titles in the digital environment

Job title	Frequency	Job title	Frequency
Metadata librarian	9	Electronic resource librarian	1
Catalog & metadata librarian	6	E-resources cataloger/coordinator	1
Head, cataloging & metadata services	4	E-resources librarian	1
E-resources cataloger	3	Head, cataloging & metadata librarian	1
Cataloging/database management librarian	2	Head, digital resources metadata section	1
Digital projects metadata librarian	2	Head, metadata & content management	1
Music catalog/metadata librarian	2	Head, serials/e-resources cataloging	1
Cataloger/e-resource analyst	1	Metadata & copy cataloger	1
Cataloger/metadata specialist	1	Metadata analyst/head, cataloging section	1
Cataloging & metadata management librarian	1	Metadata catalog librarian	1
Cataloging & metadata services director	1	Metadata services librarian	1
Cataloging & metadata services librarian	1	Metadata service cataloger	1
Cataloging/electronic collections librarian	1	Metadata specialist	1
Chinese e-resource cataloger	1	Metadata/cataloging librarian	1
Digital resources cataloger	1	Metadata/databases management specialist	1
Digital/tangible media cataloger	1	Metadata/electronic resources catalog librarian	1
Electronic resource cataloger	1	Web/metadata librarian	1
Electronic resources/serials cataloger	1	Webmaster/cataloger	1
Electronic resources/special formats cataloger	1		
		Total	58