
Shaping Medical Library Education

FRED W. ROPER AND M. KENT MAYFIELD

ABSTRACT

CONSIDERABLE CHANGE IS OCCURRING in the health information environment, signaling a need for change in the roles of health information professionals and in the knowledge and skills expected of them. This article reports the results of a survey of knowledge and skills in the health information sciences conducted by the Medical Library Association (MLA) and relates those results to MLA's educational policy statement, *Platform for Change*.

INTRODUCTION

We must educate for the problems of a generation hence, not for the problems of today...librarians must be imbued with the psychological ability to handle change and to live with ambiguity. Without this they will be performing tomorrow's tasks with yesterday's concepts. (Brodman, 1979, p. viii)

"Tomorrow's tasks" will be considerably different from those of today. The exponential growth in biomedical knowledge and the new information technologies are redefining the infrastructure of health care, education, and research. An array of professional specialties has developed, reworking what was a well-defined arena of information service. Changes in the health information environment signal change in the roles of health information professionals and in the knowledge and skills expected of them. Health sciences librarianship may not exist as a profession in the

Fred W. Roper, College of Library and Information Science, University of South Carolina, Columbia, SC 29208

M. Kent Mayfield, Second Wind, 5653 State Highway 130, Dodgeville, WI 53533
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next century unless health information professionals begin to accept responsibility for their own destinies by seeking lifelong education and professional development opportunities from a variety of sources.

The key to developing the full array of needed educational opportunities is the leadership of the Medical Library Association (MLA). By reaching out and developing partnerships with other institutions and organizations to strengthen its programs and policies in support of the health sciences librarian, MLA can provide individuals with opportunities that will prepare them for a world that continues to change radically in response to the rapid growth of biomedical knowledge and technology.

This article focuses on the Medical Library Association and its activities resulting from the work that MLA has already sponsored and because of its unique position of being able to affect medical library education and to serve as a catalyst for change.

According to the Council on Library Resources (1989), "At the heart of many of the present problems facing librarians and library education is the failure to describe the profession and its present role in terms that are compelling, expansive, and accurate. The principles, the responsibilities, and the body of knowledge that shape the profession are real and of great importance...but they are either implicit or incompletely formed and are certainly not widely understood..." (p. 26). Over the past twenty years, MLA has cited the need for a coalition of expertise and resources within the profession to define the competencies needed for professional practice and to support their acquisition in graduate school and beyond.

In May 1989, MLA's Knowledge and Skills Task Force (see Appendix A) was appointed in response to a number of different initiatives. First was MLA's own strategic plan and the strategy which seeks to influence curricula of academic institutions in the areas of design, development, and management of information systems. In order to achieve this, it seemed necessary, first, to validate what it is that health information professionals do and then to determine what is going to be needed in the future. A second impetus, closely related to the first, was the revision then underway of the American Library Association's (ALA) Standards for Accreditation of master's programs in library and information science. As a part of that revision process, each of the major library and information science associations was asked to provide the ALA Committee on Accreditation with educational and other policy statements pertinent to the needs of that organization so that they could be shared with the educational programs.

The Task Force determined that the best approach to gather the data necessary to carry out these objectives would be to survey a

sample of the MLA membership with two goals in mind: (1) to define the knowledge and skills required for competent professional performance now and in the future; and (2) to enable MLA to establish educational policies which would assure the acquisition and maintenance of those activities throughout a professional career. When tabulated and analyzed, these data would provide an inventory of knowledge and skills described in two major ways: scope—what are these skills?—and setting—where is the learning most likely to be applied and where is the learning most likely to occur?

In January 1990, an application was submitted to the Council on Library Resources for assistance in funding this survey and some other activities related to the survey. The Task Force received a grant of slightly more than \$9,300 from the council. In addition, support was received from the Medical Library Association and from the University of South Carolina.

MLA's (1992) educational policy statement, *Platform for Change*, which resulted from the survey, was adopted by the MLA Board of Directors in December 1991 (see Appendix B for a portion of that statement). The document describes the need for lifelong interdisciplinary learning for the field. It suggests that health care information will continue to grow exponentially and that health care will be one of the nation's most critical information issues. The document also provides concrete guidelines for graduate programs and insists that strong professional development roles be assumed by MLA and the National Library of Medicine.

PRIOR WORK ON KNOWLEDGE AND SKILLS

As society has moved into the information age, the need for people with a clear understanding of the many facets of the information process and with the technical skills to support that process becomes obvious. The literature of library and information science certainly does not lack for statements on what should constitute the basic body of knowledge and skills for information professionals.

Millicent Abell (1979), Toni Carbo Bearman (1984), Anthony Debons (1981), and Patricia Battin (1983) have been outspoken in identifying a baseline of knowledge and skills for information professionals that keeps pace with the rate of accelerated change that will take place in information environments. Each has expressed concern that the changing role of the professional in those environments will require a fresh look at library education and strategies to assist librarians in acquiring new knowledge and skills throughout their careers.

Woodsworth and Lester (1990) add further evidence that librarians are envisioning a new type of library and describe the following elements needed for the education of future librarians:

- A strong technical and technological base....
- Understanding of the characteristics of information transfer, including users' information-seeking behavior....
- Skill in identifying and analyzing the information needs of various constituencies served....
- Skill in evaluating information and a willingness to make relevant decisions based on expertise in both information management and subject areas or disciplines.
- Knowledge of small group dynamics.
- Understanding of the organizational culture and environmental context of higher education.
- Understanding of and ability to analyze information policy issues....
- Understanding of the impact of both the national and international economy on information access....
- Ability to analyze the political processes within the higher education environment....
- Understanding of the generation, production, and distribution of information and of the changing paradigm as shifts occur from print-based information production to other modes of production and dissemination.
- Competency in instructional design and adult education programming....
- Communication theory and its application to information repackaging. (pp. 207-08)

The Woodsworth-Lester article points to a common ground of education for librarianship, as does the work of Robert Taylor (1986), whose *Value-Added Processes in Information Systems* builds a framework of knowledge and skills that has six foci:

Information Use Environments
Intellectual Technologies
Availability of Data, Information, and Knowledge...
Information Systems and Services...
Information Technologies....
The Economics of Information Provision and Use (p. vii)

In its *Position Statement on Graduate Education*, the Special Libraries Association (SLA) (1988) arranges the competencies, skills, and attitudes that are needed in any information environment into a set of five categories:

1. Provision of information services
2. Technology
3. Management
4. Information resources, including methods of organization
5. Information service/product evaluation

There is considerable congruence at a conceptual level among leading librarians on the expanded array of competencies required

for information specialists. However, there is little empirical evidence in the literature of the knowledge and abilities necessary to work effectively as a librarian, and research documentation is limited.

Creth and Harders's (1980) 1979 survey of personnel administrators, followed by an Association of Research Libraries (ARL) (1981) survey of library administrators in research libraries, alerted the field to needs for skills in other than traditional areas of librarianship, especially automation, systems analysis, and computer-related competencies. King Research further validated the need for these skills and cited changes in the skills and knowledge needed by librarians at points along a career path (Griffiths & King, 1986).

Atkins and Georgantzas (1989), studying "Knowledge and Skills Suitable for Entry in the Information Industry" (p. 81), analyzed survey data using a multidimensional scaling methodology to map relationships between nine technical skill categories and eighteen principal organizational or functional activities. The data revealed a set of complex interrelationships which shared a common emphasis on highly developed interpersonal communication skills.

In a preliminary study to assess the level of knowledge and skills development of significance to employers of health information science graduates in Canada, Protti (1984) conducted a limited survey of senior officials in health organizations and agencies across Canada. In general, the data confirmed that employers were looking for people who are able to work and communicate effectively with others, have analytical and problem-solving skills, possess the ability to rigorously analyze and determine organizational information needs and understand the health care environment.

In their report, *Academic Information in the Academic Health Sciences Center: Roles for the Library in Information Management*, Matheson and Cooper (1982) assert that technological advances not only provide greater efficiency and allow for new approaches to the accomplishment of tasks, but that they also transform both the library and the role of the professional manager of biomedical information resources with a concomitant requirement of new skills and knowledge among health information practitioners. Recent reports of the Panel on the General Professional Education of the Physician (GPEP) and College Preparation for Medicine (1984), "*Physicians for the Twenty-first Century*" and the NLM Long Range Plan (National Library of Medicine, 1986-87) as well as the proceedings of the 1986 symposium on medical informatics, *Medical Education in the Information Age (1986)*, underscore the need for new skills in information processing, biomedical subject knowledge, consumer service, and education; the reports voice concern that new models

for professional education are essential to address changes in the social and technological environment of the future.

Similarly, documents from the Medical Library Association have focused attention on issues in education. Roper (1979) described a critical role for graduate education in the preparation of health sciences information professionals. In 1981, the report of the Study Group on MLA's Role in the Educational Process for Health Sciences Librarians called upon the association to reassess the education needed for practice in a changing environment, drawing particular attention to alternative pathways into the profession (Mirsky et al., 1982). The MLA Ad Hoc Committee on Professional Development (1984) followed with strong recommendations to work closely with graduate schools of library and information science to develop curricula which incorporate the knowledge and skills needed by health information professionals. "Shaping the Future" (Medical Library Association, 1987), the 1987 strategic plan of the Medical Library Association, further acknowledged the necessity to define the knowledge and skills needed by the field.

In 1988, MLA endorsed a new program of credentialing, the Academy of Health Information Professionals. Qualifications for the academy include documented competence in ten areas of essential knowledge:

1. Health Care Environment
2. Medical Concepts and Terminology
3. Information Needs of Health Professionals
4. Computer Hardware, Software and Information-related Applications
5. Basic Research Techniques
6. Basic Management Principles
7. Acquiring and Organizing Information
8. MeSH and NLM Classification
9. Information Sources in the Health Sciences
10. Online Searching, including MEDLINE

The MLA curriculum for continuing education reflects a commitment to those areas as well.

Mayfield (1985, 1986), Anderson (1989), and Messerle (1990) have emphasized the need for a new coalition of expertise and resources within the profession to define the skills and competencies needed for professional practice and to support their acquisition in graduate school and beyond.

Nonetheless, the literature of health sciences librarianship includes little research to support recommendations about what knowledge and skills are required to function in the environment

so compellingly described by leading information professionals, the GPEP studies, and the several reports of the Medical Library Association.

The survey conducted by MLA's Knowledge and Skills Task Force sought to remedy, in part, this lack of a research base for decision making and provides a foundation on which to develop a new consensus within the health sciences information community on the knowledge and skills required to meet the needs of health care, medicine, research, and education in technologically alert, user-driven, and rapidly changing organizational environments.

THE KNOWLEDGE AND SKILLS SURVEY

The basic objective of this study was to gather data which would provide answers to the following questions:

1. To what extent do health sciences librarians consider identified areas of knowledge and skill important to effective professional performance in the environment of the future?
2. To what extent do health sciences librarians perceive that they now possess these skills?
3. Where do health sciences librarians tend to acquire knowledge in these areas?
4. Where do health sciences librarians consider such knowledge best acquired?

In addition to these questions, the study was designed to explore possible relationships among the answers to the foregoing questions and the health sciences librarian's institutional setting, level of responsibility, and years of experience in the field.

For the purposes of this study, health sciences librarians were defined as practicing librarians or students enrolled in programs of study leading to careers in health sciences librarianship. The population was further limited to include only librarians or students in the United States and Canada. The study population was not stratified by educational background, duration of experience, or level of job responsibility. It was, however, stratified by geographical area and institutional setting, as identified in the membership database of the Medical Library Association, which provided the population from which the study participants were selected. A sample of 750 health sciences librarians was used.

A four-section survey instrument was designed to gather the data needed to answer the major research questions. The first two sections of the questionnaire consisted of twelve questions requesting information about current position, institutional affiliation, primary area of responsibility, education, and assessment of educational activities.

The third section was presented in a matrix format. Respondents were asked to provide information on sixty-three knowledge bases identified in an expert review of the literature in health sciences librarianship representing the following seven broad areas:

- Health sciences environment & information policies
- Health sciences information services
- Health sciences resource management
- Information systems and technology
- Management of information services
- Instructional support systems
- Research, analysis, and interpretation

While it was anticipated that it would be a formidable task for participants in the study to respond to sixty-three knowledge bases, it was concluded that such specificity was needed to generate meaningful useful data.

Demographic information about participants was gathered in section four of the survey instrument.

Following a pretest, copies of the survey questionnaire were mailed to 750 health sciences librarians. A total of 375 usable questionnaires, representing 50 percent of the sample population, was returned. Eighty-eight percent are employed full time and 12 percent part time. Thirty-nine percent are employed in academic health sciences libraries; 33 percent in hospital libraries; and the remainder in commercial, government, and other types of libraries. The breakdown by sex is 88 percent female and 12 percent male.

A "graying" of the field is indicated by age and years of experience. Sixty-seven percent of the respondents are age forty or older. Forty-nine percent have had more than fifteen years of experience in the field. Forty-four percent have spent five or fewer years in their present positions.

Health sciences librarians are not alone in considering the knowledge and skills required both to maintain and to improve the management of biomedical information in coming years. The knowledge explosion occurring in medicine and the basic biomedical sciences, coupled with new developments in health care management, dictates that physicians, students, researchers, health care administrators, and consumers learn to use new strategies for managing the information and knowledge available to them. Medical information science, technological change, and a growing understanding of the processes of clinical decision making may be powerful factors in information management and analysis.

The investigators thought it essential, therefore, to give experts from medicine, health care, and librarianship an opportunity to

review and comment upon the preliminary survey results, considering especially the degree to which health sciences information professionals coincided in their expectations and citing points of critical difference.

Discussions were scheduled in Washington, Los Angeles, Boston, Denver, Phoenix, and Chicago with key figures in medicine and health care administration. Leaders in library and information science were interviewed. While a number of issues were raised for further investigation, these discussions confirmed that the findings and recommendations of this study provide a sound base from which to develop a new consensus for the preparation of health information professionals.

SURVEY RESULTS

A complete report on the results of the survey will appear in the *Bulletin of the Medical Library Association* ("Surveying Knowledge and Skills in the Health Sciences," 1993). Presented here is a summary of the major findings and conclusions from the survey.

For each of the sixty-three knowledge bases, respondents were asked to indicate how important each was for effective performance in their current positions, how important the knowledge or skill was to effective performance in the health information profession now, and how important it would be in the future. The importance of each knowledge or skill was measured on a five-point scale (5, essential; 4, very important; 3, important; 2, little importance; and 1, no importance).

Table 1 displays the ten knowledge bases considered to be most important to the respondents' current positions. Health sciences information services and management of information services are the areas most heavily represented in the ten skills deemed most important now.

TABLE 1
IMPORTANCE OF THIS KNOWLEDGE OR SKILL TO EFFECTIVE PERFORMANCE IN YOUR
CURRENT JOB

Oral and written communication	3.67
Health sciences practitioners' needs	3.55
Interpersonal relations	3.47
Health sciences information resources	3.46
Retrieval techniques	3.37
Planning	3.27
Selection of information resources	3.23
Computer software	3.22
Methods of information delivery	3.18
Information needs assessment	3.17

Table 2 shows considerable consistency between importance in respondents' present position and importance to effective performance in the profession now.

TABLE 2
IMPORTANCE OF THIS KNOWLEDGE OR SKILL TO EFFECTIVE PERFORMANCE IN THE HEALTH PROFESSION NOW

Oral and written communication	3.75
Health sciences practitioners' needs	3.67
Health sciences information resources	3.66
Retrieval techniques	3.64
Selection of information resources	3.44
Planning	3.41
Budgeting	3.40
Interpersonal relations	3.38
Computer software	3.37
Development of services for information needs	3.36

Budgeting and development of services replace methods of information delivery and information needs assessment in the top ten knowledge and skills deemed most important for the profession at large.

There is a fairly high level of correlation between the level of importance of the top knowledge bases "now" and "in the future." Table 3 indicates the importance of knowledge bases for the twenty-first century.

TABLE 3
IMPORTANCE OF THIS KNOWLEDGE OR SKILL TO EFFECTIVE PERFORMANCE IN THE HEALTH INFORMATION PROFESSION IN THE TWENTY-FIRST CENTURY

Oral and written communication	3.80
Health sciences practitioners' needs	3.78
Retrieval techniques	3.71
Health sciences information resources	3.66
Budgeting	3.58
Computer software	3.57
Telecommunications and networking	3.57
Planning	3.56
Health sciences environment	3.49
Methods of information delivery	3.49

Seven of the knowledge bases considered most important for the profession now are also considered to be of great importance in the future. Other areas of great importance in the future included telecommunications, methods of information delivery, and the health sciences environment.

Respondents were asked to assess their present knowledge or skill level in each of the sixty-three knowledge bases listed. The assessment was measured on a four-point scale (4, extensive; 3, moderate; 2, slight; 1, none). Table 4 provides a list of the ten knowledge bases with which the respondents indicated the most familiarity.

TABLE 4
AMOUNT OF THIS KNOWLEDGE OR SKILL NOW POSSESSED

Oral and written communication	2.61
Health sciences information resources	2.55
Retrieval techniques	2.50
Health sciences practitioners' needs	2.49
Bibliographic tools	2.49
Selection of information resources	2.40
Methods of information delivery	2.39
Health sciences environment	2.38
Interpersonal relations	2.36
Identification of materials and sources	2.34

Of importance may be the relative ranking of amount held in contrast to the level of importance accorded to the knowledge bases in Tables 1 through 3. Among the top ten areas of knowledge or skills held, four (bibliographic tools, methods of information delivery, health sciences environment, and identification of materials and sources) are ranked below that level for the profession now. Three (bibliographic tools, health sciences environment, identification of materials and sources) rank below that for the present position. Four (bibliographic tools, selection of information resources, interpersonal relations, and identification of materials and sources) rank below that projected for the twenty-first century. Only bibliographic tools and identification of materials and sources did not appear in the top ten most important knowledge bases for current position now and in the future.

There is a fairly high level of correlation between the level of importance of each of the knowledge bases "now" and "in the future." That is, if a knowledge base were considered important "now" it was found to be important "in the future," and, conversely, a knowledge base of low importance "now," was generally found to be of low importance "in the future." However, when the focus shifts to the twenty-first century, some changes are notable, although the top four areas of knowledge and skill remain consistent with present priorities of the profession.

Those skills and knowledge which health science information professionals claim to possess least (Table 5) are in the areas of information systems and technology, instruction, and research.

TABLE 5
LEAST HELD KNOWLEDGE BASES

Artificial intelligence and expert systems	0.78
Computer programming	0.89
Systems analysis	1.03
Statistical theory	1.04
Fund-raising	1.05
Curriculum development	1.21
Evaluation of learning outcomes	1.23
Instructional design	1.24
Bibliometric techniques	1.25
Resource preservation	1.31

It is noteworthy that the skills least held by health sciences librarians are also among those considered by the respondents to be least important to the professional now and in the future.

Participants in the survey were asked to report the sources of their knowledge and skill. Six response categories were provided: library school, other formal academic programs, internship, continuing education, on-the-job, and other.

For the knowledge bases cited as important to the profession now, a majority of knowledge and skills were acquired in continuing education and on the job, with a smaller percentage of the responses representing library school. However, library school remains a strong source of knowledge and skills in areas of traditional librarianship, including selection of information resources, bibliographic tools, methods of information delivery, evaluation and synthesis of information, identification of materials and sources, and serial publications.

When plotted against the listings of either the knowledge and skills most important to current position or the list of knowledge bases projected to be most important in the twenty-first century, a similar pattern exists. Again, in areas of traditional librarianship, library school is a strong source of knowledge and skill. However, in no case is there a substitute for on-the-job experience.

Respondents were also asked to indicate where each of the knowledge bases might best be acquired. Once again, most of the knowledge and skills important to the profession now are judged to be best acquired from one of three sources: on the job (27 percent), library school (26 percent), and continuing education (25 percent).

In addition to strength in traditional librarianship, library schools are seen as a source of knowledge and skills in some areas of management, an area shared with continuing education. In reference to knowledge and skills important to current position and to the priorities for the future, the pattern is maintained. In general, the data suggest that library schools are seen as preferred sources of learning in areas other than those experienced by the respondents and well beyond the arena traditionally assigned to librarianship.

CONCLUSIONS

Many librarians practicing in the early years of the twenty-first century are currently employed in health sciences libraries. Any strategy which focuses primarily on education and training at the master's level ignores the reality that the pipeline into the profession is already full, with the bulk of the librarians already employed in health care institutions and likely to be there for the next fifteen years. This is a mature group which will need to assume greater responsibility for its own continuing education needs. In addition, it will look to its employer for support of training and continuing education both on site and from other organizations and institutions. It will demand from its professional association, MLA, programs and services which strengthen its professional competence.

Survey respondents did not identify any knowledge bases that are important now that would not be considered important in the twenty-first century. Only one knowledge base not among the top twenty for the present is cited on the top twenty list for the future: computer hardware. It is significant that the skills least held by health sciences librarians are also among those considered by the respondents to be least important to the profession now and in the future.

As with all such exercises, it is very difficult for those close to an operation to predict very far into the future. The rapidly changing health care environment coupled with the explosion of technological capabilities will certainly bring changes to how health sciences libraries and librarians operate. MLA and its partners must develop programs and services which assist MLA members in adopting technology and adjusting to the environment. MLA members must create their own vision of the future and work toward attaining that vision.

There is no clear consensus among the respondents as to the "best" place to acquire specific skills or knowledge. For skills closely connected with library functions and/or the processing of information, graduate programs are recommended. However, many respondents felt that continuing education and on-the-job training were reasonable approaches for attaining this knowledge and skill.

MLA must assist its members in identifying appropriate methods for acquisition of these skills and knowledge. Some of these specific skills are most appropriately acquired on the job. Employers will need to acknowledge their responsibility in developing training programs to support this need. Library schools have an opportunity to develop post-master's institutes, workshops, and other outreach programs in support of currently employed professionals. The National Library of Medicine can provide support for a variety of post-master's educational opportunities.

Feedback from the non-MLA participants to the Task Force on Knowledge and Skills yielded some disturbing results. The "outsiders" had a much more expansive view of what they thought health sciences librarians should and could be doing in the future. Health professionals seemed willing to delegate to librarians a greater role in the health information arena than librarians themselves seem willing to assume. If health sciences librarians are not willing to take on the responsibilities which their clientele feel are appropriate, they will be replaced by other professionals who can and will. Individual health science librarians must provide professional vision and work toward attaining it.

It is essential that health information professionals understand that individual responsibility is the key to moving the profession forward. MLA has its own role to play, and it is one for which it is uniquely qualified. It must speak forcefully and eloquently for its members. It must provide the vision and focus for other organizations and institutions which will serve as its partners in the education arena. MLA is the linchpin for developing a full array of educational opportunities because MLA is the only entity which can easily and appropriately relate to all the players.

APPENDIX A

**MEDICAL LIBRARY ASSOCIATION TASK FORCE ON
KNOWLEDGE AND SKILLS**

Fred W. Roper, Chair
College of Library and
Information Science
University of South Carolina
Columbia, SC 29208

Kent Mayfield
Second Wind
5653 State Highway 130
Dodgeville, WI 53533

Rachel K. Anderson
Arizona Health Science Library
University of Arizona
1501 North Campbell Avenue
Tucson, AZ 85724

Judy Messerle
Countway Library of Medicine
Harvard University
10 Shattuck Street
Boston, MA 02115

Rick B. Forsman
Denison Medical Library
University of Colorado Health
Science Center
4200 East Ninth Avenue
Denver, CO 80262

Phyllis S. Mirsky
Central University Library
University of California-San Diego
C-075 G
La Jolla, CA 92093

Carolyn Lipscomb
Health Sciences Library
CB #7585
University of North Carolina
at Chapel Hill
Chapel Hill, NC 27599

Reneta Webb
Medical Library Association
Suite 300
Six North Michigan Avenue
Chicago, IL 60602-4802

**Lucretia W. McClure, Board
Liaison**
Edward G. Miner Library
University of Rochester School of
Medicine and Dentistry
601 Elmwood Avenue
Rochester, NY 14642

Ellen R. Westling
Countway Library of Medicine
Harvard University
10 Shattuck Street
Boston, MA 02115

APPENDIX B

HEALTH INFORMATION SCIENCE KNOWLEDGE AND SKILLS (Taken from *Platform for Change*)

Health sciences librarianship is multifaceted. The profession acknowledges the need for knowledge and skills that intersect equally important areas: the knowledge bases of the health sciences, the application of general information principles to the health sciences setting, specific health information systems, and management and personal skills.

Health information professionals will possess varying levels of knowledge and skills in seven broad areas. No one individual can achieve mastery of all knowledge and every skill, but every organization will require collective expertise in all areas. Individuals will emphasize different areas at different points in their career, with specific needs varying over time from assignment to assignment and by institutional setting. The knowledge and skills are not listed in priority order and may be applicable to more than one area.

HEALTH SCIENCES ENVIRONMENT AND INFORMATION POLICIES

Health sciences librarians must understand the contexts in which the need for biomedical and related information emerges and the unique ways of perceiving and interpreting those environments. Therefore, they should be alert to the changing information and health care environments and the major program and policy sources, including

- legal, ethical, economic, and legislative issues;
- health sciences professions: system and structure, terminology, education and training patterns, and associations and organizations; and
- purpose, programs, and activities of MLA, the National Library of Medicine (NLM), and related information associations and organizations.

MANAGEMENT OF INFORMATION SERVICES

Leadership in the application of library and information science to the handling of health sciences information resources in complex institutional environments requires specialized knowledge, skill, and understanding of management, including

- the institution's mission and the specific mission of the information resource center;
- institutional and functional planning processes;
- decision-making strategies;
- human resources management and labor relations;
- staff development;
- project and program management and evaluation;
- organizational structure and behavior;
- interinstitutional relations;
- numerical literacy and computational proficiency;
- finance and budgeting, cost analysis, and price setting;
- fund-raising and proposal writing;
- public relations and marketing;

- facilities planning and space allocation;
- oral and written communication; and
- interpersonal relations.

HEALTH SCIENCES INFORMATION SERVICES

Health sciences librarians require knowledge of the content of information resources and skills in using them. They must understand the principles and practices related to providing information to meet specific user needs and to ensure convenient access to information in all forms, including

- information needs of health practitioners, researchers, educators, students, and consumers;
- information-seeking and transfer characteristics of user groups and individuals;
- assessment of identified information needs;
- health sciences and other information resources and their relevance to specific information needs;
- retrieval strategies and techniques;
- analysis, evaluation, and synthesis of information for identified needs;
- methods of information delivery and access;
- development of services tailored to meet needs of individual and group users; and
- resource sharing.

HEALTH SCIENCES RESOURCE MANAGEMENT

Health sciences librarians must know the theory of, as well as have skills in, identifying, collecting, evaluating, and organizing resources and developing and providing databases, including

- identification and selection of materials and their sources;
- acquisition of materials;
- bibliometric techniques;
- thesauri construction;
- bibliographic tools;
- cataloging and classification theory;
- national and international standards and conventions, including cataloging and filing rules;
- indexing, abstracting, and classification systems;
- inventory control techniques;
- serial publications;
- resource conservation and preservation;
- publishing industry;
- trends in information formatting, production, packaging, and dissemination; and
- copyright issues.

INFORMATION SYSTEMS AND TECHNOLOGY

Developments in technology have reshaped the goals and systems of health sciences librarianship and changed the way information professionals function. Health sciences librarians must be able to understand and use technology and systems to manage all forms of information, including

- basic principles of automated systems:
 - record and file construction,
 - computer hardware and software,
 - telecommunications and networking,
 - database management software,
 - systems analysis, and
 - artificial intelligence and expert systems;
- human behavior and technology;
- design, use, and evaluation of information technologies; and
- integration of systems and technologies into the long-term information management needs and plans of the institution.

INSTRUCTIONAL SUPPORT SYSTEMS

Teaching ways to access, organize, and use information to solve problems is an essential and ever-widening responsibility of the health sciences librarian. Effective instruction entails not only knowledge of the structure and content of specific courses and technology but also an understanding of and expertise in

- learning theory and cognitive psychology,
- curriculum and instructional development,
- instructional systems design,
- educational needs assessment and analysis,
- learning style appraisal,
- instructional methodologies, and
- evaluation of learning outcomes.

RESEARCH, ANALYSIS, AND INTERPRETATION

Few dispute the library's responsibility to explore the "fundamental nature of biomedical information storage, organization, utilization, and application in learning, patient care, and the generation of new knowledge" (Matheson & Cooper, 1982). In order to conduct and interpret research, the health sciences librarian is called upon to apply knowledge, skills, and understanding of

- theoretical bases of health sciences information, education, and clinical practice;
- information structure, transfer, and processing;
- analysis, evaluation, and application of research results;
- methods for evaluation of system effectiveness and efficiency;
- statistical theory; and
- research methodologies.

In the future, the profession is likely to need an array of knowledge and skills, not all of which are envisioned in this list. Developments in the field will require librarians to continue to acquire new knowledge and skills. At the same time, the profession will continue to define its mission and scope, reshaping the body of knowledge and skills—adding new ones and increasing and decreasing the importance of others.

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