
Impact of information technology on the role of health sciences librarians

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Information technology is transforming the nature of health sciences information and its management, thereby altering the traditional responsibilities of health sciences librarians. As a result, the traditional educational preparation for librarianship is no longer entirely relevant, and there is a real possibility that information management will be taken over by individuals with different educational backgrounds and skills. This paper explores four topics relevant to this issue: the emergence of new forms of health sciences information, the impact of technology on the practice of health sciences librarianship, the interaction of technology and the practice of health sciences librarianship, and the relationship among these three topics and the educational preparation of health sciences librarians.

Information technology is transforming the nature of health sciences information and its management, thereby altering the traditional responsibilities of health sciences librarians. This transformation is the basis of the core issue facing health sciences librarians today: Is the educational system providing librarians with the characteristics needed to function in a drastically changing environment? Lacking significant changes in the education of health sciences librarians by graduate library school programs, future managers of health sciences information may well not be holders of the master's degree in library science or information science but will have medical degrees or doctorates.

What prompts such a radical statement? There is no literature to substantiate my premise, no mounting body of evidence that traditionally trained health sciences librarians are being replaced by individuals with different training, no analysis of the "Positions Available" advertisements revealing a drastically new set of qualifications. Yet there is sketchy evidence, which, like the yellow sky over the prairies that portends a tornado, foretells an event of equal magnitude in librarianship, albeit not necessarily with such devastating consequences. How librarians read these signs and respond will determine the ultimate outcome. I choose to read them as a signal of change. My opinion derives solely from personal experience in academic

health sciences librarianship, a fertile field for new developments in technology. Health sciences libraries have been the testing ground for innovations in information technology, from MEDLARS to optical disk, interactive videodisc, digital video, and more. These new sources of information are qualitatively different from those that health education, health research, and health care have relied on in the past, and a different type of manager is required to select, implement, and disseminate these advances.

I want to examine four topics relevant to the education issue: the emergence of new forms of health sciences information, the impact of technology on the practice of health sciences librarianship, the interaction of technology and the practice of health sciences librarianship, and the relationship among these three topics and the educational preparation of health sciences librarians. Much of the evidence presented is anecdotal. The literature, although revealing an increasing number of articles on how to deal with CD-ROM local area networks (LANs), does not contain an overwhelming number of articles addressing education for new roles for health sciences librarians. The latter concern must be inferred from the former. Most of the signs of change have been on the Internet—questions about a particular technology, comparisons of different ways of accessing information, tips on how to "surf cyberspace," and comments about

electronic journals and skywriting. The most recent example is in the Gopher-based Higher Education Pilot Program, created by Apple. One of the disciplines represented is library and information systems. The initial comments included the following:

We are also interested in stimulating discussion about requirements for the education of the professionals required to design, create, and manage such future environments. We believe, as I believe do many others, that there is a growing un-met need for a more multi-disciplinary information systems and services professional. This professional is not in general being produced by current programs in computer science, library and information science, or management information systems programs in business schools. If we could design new learning experiences for a new breed of professionals, what would it be. We need both producer and consumer input on this [Dan Atkins, Apple USA, March 22, 1993].

It would be difficult to find a clearer expression of either the message or the medium than this!

NEW FORMS OF HEALTH SCIENCES INFORMATION

Perhaps the greatest single impediment to the continued development of librarianship has been the traditional view that librarians manage the containers of information rather than the contents—the information itself. When information was represented best on cuneiform tablets, papyrus sheets, or the codex book, this view was understandable. Indeed, information seekers looked for information by the container. But the rise of information technology—computers—quickly ended that practice. The shift to printing from movable type had increased the number of copies available, but the newly printed books were not much different from their manuscript predecessors; only more easily generated and disseminated. Much more dramatic has been the effect of information technology, which not only has increased availability of information by several orders of magnitude but also has led to different forms of information. Hypertext, CD-interactive, digital video-interactive, knowledge bases, expert systems, and virtual reality are examples of new forms of information that either are sought out with increasing frequency or are under development. This is not to say that the traditional print form or linear organization of information are dead. Both forms will persist for the foreseeable future. But the new forms, structures, and phenomena are qualitatively different and not easily handled by the traditional approaches to containers.

New forms of information appear almost daily. Fueled by advances in medical informatics, the rate of formation of these new forms and structures of in-

formation is expanding [1]. One striking example is the Unified Medical Language System (UMLS). The UMLS, formally initiated by the National Library of Medicine (NLM) in 1986, has become a major phenomenon. It is interesting that, although the UMLS project was initiated by a library and deals with a fundamental bibliographic area—vocabulary control—the major research and application efforts are being handled by individuals outside health sciences librarianship. Another example of a new type of information, in both form and structure, is the medical logic module (MLM). An MLM is an integral piece of knowledge in clinical decision-support systems, and its description, listing, and access are vital to both developers and users of these systems [2].

There are many more examples of newly developing forms and formats of information driven by the microcomputer revolution. Following is a random sample of indicators of how health sciences information is changing, both structurally and intellectually. An article in *Medical Informatics News* briefly describes resources such as the Digital Anatomist from the University of Washington and several NLM initiatives, including a digital X-ray project and the Visible Human project [3].

The table of contents of the *Annual Review of OCLC Research: July 1991–June 1992* lists articles on database quality control, assessing information on the Internet, the graphical browse project, interface design procedures, and automatic hierarchical organization of phrases using machine-readable dictionary information [4]. Do these sound like the types of projects librarians usually handle? And the table of contents of the *Bulletin of the Medical Library Association* is equally interesting. Of the main articles in the January 1993 issue, 25% are by physician authors and deal with the use of computer software by physicians to answer clinical questions and an application of UMLS. What does this suggest?

Forsythe et al. presented a major study of physicians' information needs, which stressed an expanded concept of information [5]. Regardless of whether their observations and conclusions regarding a physician's information need are accurate, the significant point is that a major research study on this issue was conducted by two individuals from a department of computer science and two from a section of medical informatics. This is an example of research, natural for librarians, being undertaken by others. Librarians either are unable to do it or do not perceive information in an appropriate way because they do not recognize the container.

The table of contents of the *Proceedings of the Sixteenth Annual Symposium on Computer Applications in Medical Care* reveals a plethora of articles reporting research either in information organization and retrieval or the structural aspects of information [6].

Again, virtually none of the authors is a librarian, even though the topics include an automatic link from the hospital information and decision-support system to MEDLINE and the use of the Arden Syntax to represent knowledge. Major areas of investigation and development of new knowledge sources are described, but, again, the containers do not look familiar, which may be why the faces of the presenters often do not either.

Finally, the table of contents from *Multimedia Computing in the Health Science Library* lists a series of chapters on how to equip a multimedia computer laboratory to handle new forms of information [7]. It is revealing in its description of the new types and forms of information that are developing and what is required to manage them. And, although the intent of this publication is to provide practical advice on establishing a multimedia learning center, the end of the first chapter may prove to be prophetic: "The easiest and simplest route to take is to do nothing until standards emerge and hardware platforms become less expensive. This is a rapidly developing field, however, and it may be difficult to wait and watch while others begin to make use of the available new technologies."

IMPACT OF INFORMATION TECHNOLOGY ON HEALTH SCIENCES LIBRARIANSHIP

Information technology has had a two-tiered effect on the environment in which librarians practice. The first effect, described earlier, comprises new types, forms, and structures of information that are being developed, demonstrated, disseminated, demanded, expected, and used by our constituents. The second effect can be seen in what librarians do and how they practice.

Information technology has had a Darwinian effect on the practice of health sciences librarianship. It has applied pressure so that tasks have evolved and either have changed into new, more adaptive forms, or have disappeared because they were no longer useful. This does not mean that only the fittest health sciences librarians will survive, although this possibility does hover in the background. More ominous is the potential effect of natural selection on survival of the entire species. Are new species better adapted than traditional librarians to manage information in this changed environment?

The librarian's traditional roles can be characterized briefly as selecting, organizing, and making available the biomedical literature and providing support to users. These roles have not changed much, except that technology is transforming the tasks. Here are some obvious examples. In the area of collecting, the combined phenomena of declining budgets and

advances in information technology have led to just-in-time rather than just-in-case collection development. With the increasing availability of information on networks, this new approach is feasible, but the support function has become a technology circus. The traditional role of providing bibliographic instruction has been transformed into a curriculum of microcomputer courses ranging from introduction to MS-DOS or the Macintosh to instruction in statistical, presentation, or desktop publishing software. Academic health sciences libraries routinely teach basic courses in word processing, spreadsheets, and database management along with the expected courses on how to search using GRATEFUL MED or some local system. How frequently do librarians show a user how to use a print bibliographic source? The reference desk remains vital, but is anyone studying the nature of users' questions? In many libraries, the reference desk has become the help desk.

While traditional tasks have evolved, some new tasks have emerged. Again, anecdotal examples will have to suffice. More and more libraries are involved in network planning, implementation, and management. While this trend might be characterized as the natural evolution of a library's role, the new tasks are qualitatively different and, thus, new. This phenomenon is reflected in the role and responsibility of directors, whose titles, by the way, are becoming broader (e.g., "associate dean for scholarly resources," "assistant vice chancellor for academic information management"). These new information technology tasks also are reflected by the topics addressed in a selection of library newsletters. It is a journalistic axiom that newspapers can devote only so many column inches to any story and that the amount of space devoted to any given topic is a reflection of the editor's judgment of the importance of that topic to readers. Library newsletters are beginning to look like they were published by the computer services department. More inches seem to be devoted to new electronic forms of information, new electronic services, or network and computer configuration information than to announcements of new books or new serial titles.

Another area in which information technology has produced a qualitative change is in the decision process for selecting technology. There was a time when libraries were reluctant to purchase a videotape without faculty review, because the \$300.00-\$500.00 purchase price had to be justified by use. This problem may seem amusing now, when libraries are making selection decisions for computers or networks that have price tags in the tens of thousands, and the implications of these decisions are orders of magnitude greater than those involving videotape use. If a library selects a computer system without careful attention to networking or telecommunications pro-

protocols, the unintended effect may be to constrain the library's future role.

Finally, the librarian's traditional tasks are described in relation to the literature. Today's information resources hardly can be described with that term, nor can the nature of the container be assumed. An interesting piece appeared on the Internet, a description by a librarian of efforts to establish an information resource using Gopher and WAIS. The librarian was establishing subject-specific, electronic carrels by setting up microcomputers such that users would have access to all the information on a specific subject available in the host library and in information repositories or sources on the Internet. What was enlightening about the piece was the vocabulary used to describe the activity and the knowledge of computer science revealed by that vocabulary, both of which implied that new containers of information and a new species of librarian were appearing. *Librarianus literaturus* either is evolving into *Librarianus electronicus* or is becoming extinct, to be replaced by *Medicalus informaticus*.

THE INTERACTION OF TECHNOLOGY AND HEALTH SCIENCES LIBRARIANSHIP

An organization can be viewed as a complex system, with interrelationships among tasks, technology, structure, and staff, according to a model proposed by Leavitt [8]. Applying the model to the health sciences library, it is clear that the technology used to perform tasks has changed dramatically, as have the tasks themselves. Also visible are the beginnings of the change in structure, as indicated earlier in the new titles for directors of academic health sciences libraries. But it is the effect on staff that is at the core of debate. It is the premise of this paper that a different kind of staff will be needed in the new information technology environment. The question is how to change educational preparation to adapt to this new environment. Before answering this question, architects of change must examine the new environment to see what it reveals about the characteristics librarians will need to survive and prosper.

First the doomsayers—only a selection, for the literature is full of them. Henry makes the case for the computer as a routine tool for the education and practice of medicine [9]. He points out that a text is usable only in the library and that new, representational forms of information—knowledge frames—are viewed more readily via computer than by visiting the library to find them in texts or journals. Rootenberg believes that computer oversight should be handled by a dean for curricular activities and seems to ignore the role of libraries in his study of how medical schools are implementing information technology

[10]. Kassirer, in addressing a slightly different topic, implies that librarians not only are no longer needed but also may be an impediment to information access in today's information technology environment [11]. Park offers an extremely interesting view of the possible marginalizing of librarianship [12]. Finally, Holderness pronounces libraries dead but not necessarily librarians [13]. With all information available electronically, the librarian will become a theoretician on information management rather than a custodian of bookshelves.

Others describe a new environment that retains the librarian or some reasonable facsimile thereof. Plutchak, writing in *Medical Informatics News*, claims to have had a transcendental experience as a result of attending a course in medical informatics [14]. Noting the different backgrounds and skills of librarians and individuals in medical informatics, he suggests that success requires cooperation and that exploration of these issues is not an academic exercise but a preview of the future. As to whether the fundamental nature of libraries is changing, he says it depends upon how the nature of libraries is defined. Defined by the tasks, it is changing radically; defined by the responsibility to manage the biomedical knowledge base, it is not changing at all. But, to fulfill this latter role, libraries must engage medical informatics and its practitioners.

Early descriptions of the library and librarians that present new roles are provided by Molholt [15] and Lucier [16]. Molholt describes a future of integrated technologies where librarians play a major role in the integration. Lucier describes the earliest endeavors of a library involved with knowledge management. But perhaps the quintessential description of the future environment for health sciences libraries is provided, again, by Lucier [17]. He describes a radically new and different environment for biomedical information management with a strong role for the library and its staff. His description of new tasks and roles should be viewed as both a challenge and a call to action for future health sciences librarians. It also can serve as an indicator of the types of skills that will be needed in the brave new world of knowledge management.

Another indicator of the new environment and new roles came over the Internet, in the form of an announcement of a meeting entitled "Access and Beyond: Emerging Roles for Information Professionals." The focus was challenges and opportunities for the information profession and demands for expertise in nontraditional areas brought about by enhanced user expectations and advanced technology. Three topics were presented: the librarian as system designer, the librarian as data evaluator, and the librarian as educator and consultant.

Two other aspects of this issue must be addressed.

The first is career path. Where do librarians ultimately want to end up? What are the expected job titles? Titles such as "vice president" or "associate dean for information resources" reflect a broader responsibility for managing the information enterprise than existing titles. Some health sciences librarians already have moved to a level above the library directorship or have combined responsibility for both the library and other information components of the institution (e.g., managing the LAN, directing biomedical communications, head of academic computing). The question is, who should take on these new roles and what kind of preparation should they have? Librarians should ask themselves what job they want or for what job they feel they are best suited. The answer will indicate what they need to do in the way of preparation. As implied by the Leavitt model and envisioned by Lucier, the changes in tasks, the technology used to perform those tasks, and the structures that are evolving for the accomplishment of those tasks all affect the staff that will be responsible for managing information.

The second aspect is evaluation. How should performance be measured or judged? Librarians have allowed themselves to be identified with the containers of information rather than with the information itself. They have encouraged this linkage by organizing information by form and striving for increasing numbers in each category. It is the ultimate insult to rank libraries and, by innuendo, librarians, as though they move up in rank by numbers alone. The result is that the only good library is a big library. How should the new sources of information—medical logic modules, for example—be counted, and how will they ratify the librarian's professional role?

The prevailing attitude today is that as long as information is considered print or the container of the information looks like a print product, the library is the appropriate location for it, and the librarian is the appropriate manager. But, when information is not print or does not come in a container, managers other than librarians are viewed as responsible. What is the librarian's legitimate claim to information management as opposed to information container management? What is the defining characteristic that sets librarians apart from all the others who now sense a power base in information management and are ready to take over the library's role and responsibilities? How can librarians prepare themselves to be successful in this new information technology world?

IMPACT ON EDUCATION OF HEALTH SCIENCES LIBRARIANS

The first question is, how has the librarian's role been defined, and what have library schools been teaching? The answer reflects an ongoing conflict between

education for librarianship and training for work in a library. Demands for specific skills by hiring libraries led to the schools' emphasis on preparing graduates for a job rather than educating them for a profession. And the skills were primarily in information container management. Low entry-level salaries did not provide an incentive to prolong the educational period either, adding to the problem. Library education provided graduates with skills to perform tasks, but, when the tasks changed, the required skills changed also. And it is these new skills, essential to the information technology age, that are not being taught in library schools.

The purpose of this paper is not to criticize library schools or library education. Others have raised such criticisms [18]. Rather, the intent here is to point out new roles for librarians and new ways that libraries will be evaluated so that the requisite new knowledge and skills can be discerned. Librarians already have many skills that are essential in an information technology age. From knowledge of bibliography to understanding of the sociology and economics of information, librarians have much to contribute. But librarians are known especially for service. No information system will be useful if it is not designed or operated in service to the user, and no one knows that better than librarians. The academic librarian of the future needs to look beyond traditional skills and the traditional library school curriculum for preparation. Whether the schools make the appropriate changes is irrelevant, because there are other ways to prepare (e.g., individuals interested in medical informatics usually come from a medical program or from some other field and obtain a Ph.D.). The fact is that the traditional library school curriculum is not preparing graduates to perform in the information technology environment of the future.

The next question is, what is that environment, and what kinds of information management positions will be available? The job characteristics will determine the nature and type of education that should be acquired. A couple of position advertisements have come over the Internet in the last several months that are indicative of the changing nature of jobs in academic health sciences libraries. The most intriguing was posted by the University of California, San Francisco, which was looking for a director, center for knowledge management, a position as a member of the senior management team of the university library and the center. The qualifications required would be difficult to acquire in library school today.

Another Internet document, "What Presidents Need to Know about the Integration of Information Technologies on Campus," is equally revealing. This report later was described in the *Chronicle of Higher Education*; the full report was available from its publisher, but it was available immediately on the Inter-

net [19]. The thrust of the report is that in much of higher education over the last decade, information technology has been applied primarily in automating administrative functions. The focus for the next decade on many campuses will be on making strategic technology investments to increase academic productivity and to re-engineer administrative processes for greater efficiency. The report makes suggestions for successfully developing information technology and integrating it into the campus community. The conclusion speaks to the future environment for health sciences librarians:

With the explosive increase of networked services and resources, we are beginning to realize the goal of having the world's information, not just that of our own departments and institutions, at our fingertips. Along with the overwhelming abundance of data and technologies for data delivery come fragmentation of areas of expertise and an increased need for coordination and integration. The president must create a climate where risk-taking and innovative solutions are encouraged, where an accessible information infrastructure links a multiplicity of activities. With thoughtful, high-level, committed guidance, the information technologies can be a catalyst for integrating and energizing our professional community.

This paper set out to prove that information technology is transforming the environment in which librarians work and changing the skills needed to function in that environment. Clearly, education should provide the knowledge and skills to succeed in the future environment. The key issue was and still is, are librarians going to be involved in information technology to the extent that they have been involved in managing the literature in the past? And, if so, then, what educational preparation will be required? There are no easy answers. Indeed, at this stage there is only a question: Will the next generation of librarians be viewed as competent to be hired by a university president?

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