Drug information skills for pharmacy students: curriculum integration

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For pharmacy students to provide optimal and complete pharmaceutical care, it is vital that they develop drug information skills. At the University of Southern California, the School of Pharmacy and the Norris Medical Library have established an interactive educational program. Library programs support an increasingly complex progression of information retrieval, evaluation, organization, application, and communication. Librarians are systematically involved in all four years of coursework for the doctor of pharmacy degree. Training and experience in computer literacy and online database searching are included in the library components. Description of the educational program covers its beginning a decade ago, current status, and future in an environment of rapidly advancing technology.

The complexity of the drug information field and the expanding roles of pharmacists as information resources demand that students be trained thoroughly in the skills necessary for handling information. Prior to entering pharmacy school, many students lack basic library and information research skills, and all need instruction to reach necessary levels of bibliographic and drug information expertise. Students who do not understand how to use a library catalog or a printed or online index are at a disadvantage; they cannot be expected to research the pharmaceutical journal literature or find foreign drug information in an online database. Health sciences librarians can and should train pharmacy students in this entire spectrum of activities.

Teaching library and literature research skills in the curricula of pharmacy schools has been discussed for at least two decades [1-7]. Rather than develop separate library courses, Sewell et al. describe integration of bibliographic skills into a series of existing pharmacy school courses [8]. At the Norris Medical Library, University of Southern California (USC) Health Sciences Library System, a program of bibliographic and drug information instruction is integrated into the School of Pharmacy curriculum at all four years of the doctor of pharmacy coursework. There is an additional seminar for pharmacy residents.

This paper describes the development of the USC

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library's educational program on drug information for doctor of pharmacy students. The discussion covers the beginnings of the program a decade ago, its current status, and its future in a technologically advanced environment.

PROGRAM BACKGROUND

The Norris Medical Library's discussions with the USC School of Pharmacy faculty a decade ago were the beginning of the integrated instructional design process. Faculty explained the need for increased student learning experiences to build drug information skills. Observations from the librarians and pharmacy faculty confirmed that students were not skilled in finding drug information; neither were students aware of the wide range of medical and pharmaceutical literature. The faculty observed deficiencies in students' communication skills and in their ability to relate pharmaceutical and medical knowledge to practical situations. Previously there had been a brief orientation to the library and its information sources, along with the assignment of simple drug information questions; however, this was clearly not enough.

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The literature confirms the need for enhanced training. A strong statement about deficiency in pharmacy education was found in the 1975 report of the Study Commission on Pharmacy [9], which criticized the pharmacy profession's organization and transmission of drug information. The report emphasized the increasing significance of drug information, and the need for changes in pharmacy education and training as pharmacists are called upon to be more sophisticated and knowledgeable. Subsequent writings have reaffirmed this conclusion [10-11]. Pharmacy students need education and experience in using literature sources and drug information systems; thus they become more effective and efficient in dealing with the analysis and dissemination of drug information [12]. Today students must also have training and experience in using computerized information systems. As Brodie and Smith state, "Adapting to the age of knowledge and technology is not an option; rather, it is an imperative" [13].

The pharmacy education literature contains an abundance of material about the need for educational programs within pharmacy curricula that emphasize

drug information skills. Students should be able to apply theoretical knowledge and research methods to problem-oriented case studies and real-life clinical situations [14]. Pharmacists need to be capable and effective drug information consultants to peers, colleagues in other health professions, and patients [15-16]. Of particular importance is the need for experience in communicating drug information throughout students' education, not in just one course. Pharmacists need knowledge about the identification and evaluation of resources, including online information systems. Results of a 1984 survey of pharmacy educational programs suggested that "many of today's pharmacy students may not be receiving sufficient drug information training ..." [17].

To initiate development of the USC program a decade ago, a core working group was established to interact with the school's Pharmacy Curriculum Council and to devise a model program that would address the recognized needs. The working group consisted of an instructional design specialist, a pharmacy faculty member, and the pharmacy liaison librarian. The librarian participated in the development and implementation of the program by organizing support from the library, later preparing and teaching class sessions. The goal of this original program was to develop the drug information and communication skills of the pharmacy students so they could fulfill a significant, unique role in health care through their knowledge and experience.

The original intent of the program has changed little during the past ten years. The core working group that initially developed the library program believed in the importance of libraries and librarians as information resources for the pharmacy profession. They wanted to instill this outlook in pharmacy students. In a 1985 report that included a study of pharmacists' needs for the information services of a medical library, the researchers found that younger pharmacists and those working in a hospital setting were more likely to use the library [18]. The authors commented that this trend may be a result of training and education and that health professionals are becoming more dependent on library information. The current program, like the original one at USC, continues to emphasize that pharmacy students need to gain experience using library resources; they need to be aware of the value of using the resources available and the services of librarians as partners in the health care team.

The original program served as a basis for the current program. Learning activities at the library during the first two years included a lecture component but were largely experiential. The identification and use of drug information resources were taught by lecture and demonstration. Students then had direct experience using and discussing relevant library mate-

rials. Library assignments for research with written and oral presentations were related directly to particular pharmacy classes. Progressive levels of learning activities with library support during the third and fourth years were designed to build skills for identifying and evaluating drug information, solving specific patient problems, and communicating this information to immediate colleagues, other health professionals, and patients.

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THE CURRENT PROGRAM

During the past decade, the library and pharmacy school program has evolved in content and method to include the developments in technology that enable end users to do their own bibliographic searching; microcomputers now exist in many offices and clinics. However, the goals of the original program model have remained largely unchanged. The current program continues to emphasize the retrieval, evaluation, organization, application, and communication of drug information. The program also stresses the pharmacy profession's use of libraries and librarians as information resources, and ways in which librarians can assist in developing student awareness of the need for lifelong professional development and learning.

Overview

Bibliographic and drug information instruction has been integrated into the classes at all four levels of the existing curriculum. The content provides stepwise learning with increasing complexity throughout the coursework for the doctor of pharmacy degree. Each year's work reinforces and builds upon what was taught in the previous year.

The progression begins with basic library orientation and retrieval of drug information in the first year, then continues with evaluation of printed and computerized tools in the second year. Also in the second year, students present what they have learned to one another in small groups. The third year introduces the application of drug information to patient cases and further builds communication skills. The online database searching taught in the fourth year enables students to become more independent and enhances their drug information research. Computer literacy and computerized literature-searching skills are emphasized throughout the program.

Technological advances in both the information retrieval and pharmaceutical fields have altered teaching content and technique. It is now realized that students need computer skills to maintain awareness of the exploding drug information literature. When they leave pharmacy school, students must be able to use electronic forms of communication and computerized databases.

Evaluation

Regular contact between the liaison librarian and the faculty members whose courses have a library component ensures the quality and relevance of the program. The librarian ensures that these contacts are made prior to the beginning of each semester and that any changes in personnel or course content are reflected in the library program. Topics for student research are revised each year to include recent developments. Examples of topics added in recent years include AIDS and gene cloning. During these meetings, the librarian shares with the faculty the evaluations from the first- and second-year program segments and observations made by students at the library. The observations include the numbers and types of questions asked of librarians, the students' apparent familiarity with the printed literature, and the amount of handbook and index use. Librarians are currently able to evaluate formally only those parts of the program where librarians administer the tests and assignments. Informal evaluation of the students' progress occurs as reference librarians help students with assignments. The type and frequency of students' questions indicate where the program needs enhancement or change.

While both faculty and librarians have independently observed the students' improved skills, there has been no thorough, formal evaluation of the program. The librarians have written their own pre- and posttests and discuss each year how best to organize the work load of teaching and supervision. Faculty and librarians have not shared evaluations in any formal manner. Efforts would be enhanced by the coordination of evaluation instruments and a follow-up study of pharmacy graduates.

Practical matters

One-on-one and classroom instruction take place both within the library and at the pharmacy school close by. Direct NLM MEDLINE searching is done for a fee by librarians or by users with their own passwords at designated microcomputers. MEDLINE on CD-ROM is available free for any library user.

Each year's class has approximately 160 students. One pharmacy liaison librarian coordinates the program but receives help in teaching and demonstrating from a total of six information specialists. Each

of these six librarians spends several hours with the first- and second-year students. The librarian who is also the online search coordinator supervises the training of the preceptors in the fourth-year program and spends several hours in the spring helping fourth-year students with their searches.

First year

The library invites first-year students to a general class on computer literacy. In 1988 about half the students arrived at pharmacy school with some computer background. A two-hour session, which includes practical experience in the basics of microcomputing and word processing, is given to provide minimum levels of competence. A further lecture discusses the library's extensive microcomputer facilities and the availability of drug information via online databases. The popularity of the library's microcomputer facilities among pharmacy students increases annually.

By the end of the first semester, students should be able to:

■ identify and locate library materials by author, title, or subject;
■ understand how to use printed *Index Medicus*;
■ identify bibliographic citation elements;
■ locate journal holdings at Norris and affiliated libraries;
■ understand the usefulness of online bibliographic databases; and
■ acquire basic proficiency with an end-user database searching system (CD-ROM).

First-year students have widely varied understanding and competence in using libraries and information resources. The thrust of the first-year program, therefore, is to introduce students to the pharmacy literature and its organization, publication, and retrieval, with emphasis on library and information-seeking skills.

A first-semester course introducing pharmacy practice begins with a two-hour library orientation. The pharmacy liaison librarian gives a forty-minute lecture describing the library's collections and services; the lecture includes an introduction to *Index Medicus* and an explanation of how to find information in the library by author, title, or subject. A thirty-minute slide-tape program is then used to describe the library's layout and how to locate library holdings. The final segment is a demonstration of MEDLINE, the major index to the biomedical literature, available in the library online directly to NLM and on CD-ROM. For evaluation, students are given pre- and posttests and an assignment that is corrected by the librarian and returned to the students. Results indicate that students do accomplish the objectives.

By the end of the second semester, students should also be able to:

■ differentiate types and functions of information resources, e.g., handbooks, indexes, journals;
■ understand the process by which pharmaceutical literature is published;
■ understand the concept of peer review; and
■ begin to evaluate drug information by authority, timeliness, and relevance.

At the beginning of the second semester, the pharmacy liaison librarian gives a more detailed two-hour lecture in the first session of a course on literature evaluation and biostatistics.

This class also has an assignment. Students are required to locate journal articles that demonstrate research methods and prepare a short description for presentation in a class session at the pharmacy school.

The most common complaint among first-year students is a request for more supervised CD-ROM searching or more free time searching MEDLINE directly rather than the hands-on practice provided in class. (In 1989, this problem was resolved by the provision of locally-mounted MEDLINE at the university, free to all library-card holders and available at terminals in the library.)

Second year

Library involvement in the first month of the microbiology course at the beginning of the second year is more intensive than the first-year program. The purpose of the program at this level is to provide practical experience in finding drug or related health information on specific, individual topics. The students must analyze their information needs, then select the appropriate sources to meet them. Librarians discuss appropriate search strategies for handbooks and indexes with small groups of students to help in the choice and evaluation of sources. In addition, students communicate their findings in both small-group and large class settings.

The class of 160 students is divided into groups of ten. Each group makes an appointment to come to the library for a two-hour class session. Six Norris librarians share the teaching. Each student is given volumes of *Index Medicus, International Pharmaceutical Abstracts, Science Citation Index, Current Contents,* and *Drug Literature Index.* The librarian assigns a drug topic, and the class members locate articles in the various indexes. Class discussion ensues, comparing what students have found. The librarian then hands out thirteen different pharmaceutical handbooks. Students are given a few minutes to find information on the assigned drug topic. The librarian takes two of the handbooks, demonstrating what each student is expected to present regarding the content, authority,

timeliness, organization, and scope of the work. In class discussion, students compare the handbooks and contrast the information found in the indexes and handbooks. At the end of the session, each student receives a research topic that requires the use of indexes and handbooks. A brief presentation is given in a later antimicrobial therapy class, reiterating the methods and sources used to locate the information. Thus, students are gaining experience in finding, organizing, and evaluating drug information, then in presenting it to others.

At the end of the semester, students are asked to complete an evaluation form regarding the library component of the course. They are asked to rate the usefulness of the program as a whole and its effectiveness in meeting specific learning objectives. The most highly rated components are usually instruction in the use of *Index Medicus* and the hands-on experience with the handbooks. Most students rate the program as "very effective" in improving their use of library information sources and comment on the practicality of the small-group segments.

Third year

Activities at this level introduce the application of drug information to patient cases. Two semesters of clinical therapeutics courses concentrate on the pathophysiology of disease and related therapeutics. Librarians are not directly involved in teaching in this year and therefore have no stated goals or objectives for the students. Students participate in clinical workshops and work with others in the evaluation of drug therapy in prepared cases. In addition, they are assigned patient-related topics to be presented in class after library research. Related background reading materials, such as copies of journal articles, book chapters, and notes provided by professors, are placed on reserve in the library. Students are expected to do further independent research on their assigned topics. Although librarians do not take part in the teaching in this year, they are notified by the faculty of the topics that have been assigned and discuss with faculty the amount of help that students can expect when they come to the library. Many students request computerized literature searches from reference librarians or perform searches themselves using MEDLINE on CD-ROM.

Through these experiences with individual topics for library research, students become more independent learners. Their personal research into practical topics that relate directly to patient care stimulates self-motivation. Presenting findings builds verbal and written communication skills.

Fourth year

By the end of their fourth year, students are expected to:

- understand the structure and content of MEDLINE;
- know how to log onto the MEDLARS system using standard telecommunications software;
- formulate search strategies that include multiple concepts such as disease, drug, and dosage;
- interact online with the database, limiting searches by subheadings and check tags; and
- print or capture retrieval to disk.

Pharmacists today depend increasingly on microcomputers. One goal of the library's pharmacy program is to familiarize students with microcomputers, especially their use for online literature searching. MEDLINE is demonstrated in the first-year class, and students are encouraged to request online literature searches from librarians throughout their years in pharmacy school. A small fee is charged for these searches, and no free passwords are available. Increasing numbers of students use MEDLINE on CD-ROM, which provides quick and easy access to a limited part of the database. Direct online searching with NLM command language, however, provides access to databases other than MEDLINE and enables the user to search more efficiently and comprehensively.

To provide students with comprehensive online searching skills, preceptors from the clinical pharmacy faculty in the acute care therapy clerkship teach fourth-year students to search MEDLINE using NLM command language.

To provide students with comprehensive online searching skills, preceptors from the clinical pharmacy faculty in the acute care therapy clerkship teach fourth-year students to search MEDLINE using NLM command language. The preceptors themselves are trained originally by librarians. Funds for online charges are provided by the pharmacy school. After an initial lecture, students attend a three-hour practicum. The lecture covers the principles of online searching—the use of a controlled vocabulary, Boolean operators, and field-specific searching. MEDLINE commands are taught, together with a description of the database and instructions for logging onto the system. The practicum takes place in the library's microcomputer classroom. A librarian illustrates retrieval of references on a given topic; each student then duplicates the exercise online. The librarian discusses search strategy formulation and compares retrieval using different strategies; once more, students duplicate the searches. Students are then assigned topics and encouraged to experiment with various formulations. Over the next six weeks, they are encouraged to make arrangements with their preceptors or a librarian for one-on-one help in formulating and

executing searches. Students perform an average of four to six searches each. Further consultation with librarians is available as needed.

A further activity for fourth-year students is an elective clerkship at the Drug Information Center (DIC) at the affiliated Los Angeles County General Hospital and at other DICs in the Southern California basin. The DIC and the Norris Medical Library are aware of each other's collections and activities and cooperate in providing information service. As in similar programs described in the literature [19–22], the USC fourth-year students receive practical experience at the DIC, participating in all of its activities. They use various reference and indexing sources for answering specific questions. This clerkship complements the drug information component of the library program.

Six clerkships, each of six weeks duration, make up the final year of the curriculum. In all the required and elective clerkships, students are required to give presentations on patient cases in a professional setting. The library plays a vital supportive role during this time: librarians guide students in finding information for their case conferences, perform computerized literature searches, and help students to search for themselves on CD-ROM or by direct MEDLINE access.

Pharmacy residents

The USC School of Pharmacy offers a one-year postgraduate training program (residency) in specified clinical pharmacy areas. About one third of the USC residency participants are from other schools. They have not necessarily experienced the type of bibliographic and drug information program that is provided at USC. A single-session, three-hour library seminar is therefore held in the fall of each year for orientation and review. The seminar format and content depend largely on the needs of the particular group. Orientation to the library's collections and services, plus review of relevant reference and indexing sources, are usually included. Discussion and questions are encouraged. The seminar typically includes a demonstration of online bibliographic searching and comparison of pharmaceutical handbooks. Librarians are available for consultation upon request at any time during the pharmacy residency; further training in both computer literacy and the searching of online databases is available through existing library programs.

THE FUTURE

The Task Force Report of Competency Statements for Pharmacy Practice [23], presented to the American Association of Colleges of Pharmacy at their annual meeting in 1987, confirms that many responsibilities of pharmacists require skills in the performance of drug information research, application, and communication. Researching the medical and pharmaceutical literature and maintaining access to current drug information, for example, are specifically defined as necessary skills for patient care and for provision of drug information to other health care professionals. Library participation in pharmacy education can help to develop these skills. It is the responsibility of pharmacy education to build these skills, using the latest technological advances.

Technological developments in computerized drug information systems and advances in pharmaceutical research will demand changes in drug information training programs. The following developments will affect such programs:

- The drug information literature will continue to expand rapidly with biotechnological research advances; current awareness will be critical.
- The pharmacist of the future will increasingly be using computerized drug information systems with direct access to online databases to identify needed drug data and literature.
- Libraries will expand their microcomputer facilities and training programs in basic computer and drug information skills.
- More librarians will act as consultants to health care professionals for electronic access to the biomedical literature.

Health sciences education is becoming more problem-oriented and employing new techniques, such as computer-assisted instruction and interactive video programs, thus changing the traditional roles of teaching faculty and librarians. Technological advances are enhancing students' learning experiences and preparing them for professional practice. The Norris Medical Library provides extensive microcomputer facilities for both students and faculty. Librarians use these facilities to teach computer literacy and demonstrate software for online database searching and information management. The library routinely acquires self-directed learning programs on diskettes, laser disks, and videotapes. These programs are frequently patient-oriented. USC pharmacy faculty members have written their own problem-oriented pharmacokinetic modeling programs for student learning within the library.

New educational needs arising from technological advances should continue to be assessed. The library can and will work in tandem with the pharmacy school to meet these educational needs.

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FROM THE *BULLETIN* — 25 YEARS AGO

Random thoughts about medical library planning

By Alderson Fry, Librarian, Medical Center Library, West Virginia University, Morgantown, West Virginia

Most of the rest of this talk is devoted (and you may consider that word either in the sense of the minister or the agent provocateur) to an attack on the idea that most of us must keep building bigger and bigger libraries, or at least putting more and more books in them. We must be concerned (1) with adding to that huge mass of books we have back in the bowels, or megacolon, of the library or (2) with getting rid of this matter altogether. This latter action will result in saving money, running more efficient libraries, and, unfortunately for some of you, building fewer libraries. Naturally I think it will be fortunate for the rest of society.

Some of my attitude is easy to illustrate. Thank God for that accretive hi-fi set, the engaging TV, the amiability of the car, and the blessings of medicine in eliminating a great deal of only marginal health, thus making available energy for something besides reading. They are breaking the stranglehold of the writer-publisher-critic guild, which would have us believe reading is man's highest pursuit. As Peter Dooley said, "Readin' ain't thinking." And Oscar Wilde said, "Work is the curse of the drinking class." Well, print is the curse of the thinking class.

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