Web-Based Library Instruction for a Changing Medical School Curriculum

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ABSTRACT
This article describes how librarians at the UCLA Louise M. Darling Biomedical Library adapted to changes in the Medical School's curriculum, developed new ways to support the school's instructional goals, and provided information literacy instruction. Encouraged by the school's growing awareness of, and reliance upon, computerized information to support the educational process, librarians worked with faculty to develop new approaches that would meet the changing needs of both student and teacher. Advances in information technologies provided alternative instructional delivery methods that accommodated both the numbers of students (150 for each of the four years of medical school) and the range of issues being explored by these students.

BACKGROUND
Delivering information literacy instruction to students who generate their own problems, do not meet in large groups, and who study topics that change on a monthly basis can be problematic. This was the challenge faced by reference librarians at the UCLA Louise M. Darling Biomedical Library when the UCLA School of Medicine's curriculum began to evolve from the traditional lecture-based approach to one that focused on a more interactive self-directed mode of instruction known as problem-based learning (PBL.)
An initial survey of available options revealed that live classroom instruction would not be adequate in addressing the problem based learning approach with the large number and variety of topics being explored. An ideal medium would deliver information and instruction when and where the students needed it. But, if you build it, will they come? This has been the age-old question facing information professionals who develop and provide instruction. The most successful instruction programs are those that teach skills relevant to the learners' immediate needs and whose objectives are linked to those of the academic or professional program the instruction is supporting. As with most things in life, timeliness tends to be everything. For librarians at the UCLA Biomedical Library, the move toward PBL offered both challenges and opportunities. Just as information literacy was becoming a major theme in librarianship in the mid-to-late 1980s, medical educators were exploring ways to reframe their methods and curriculum to promote the development of a different, more responsive, self-directed type of physician.

Although information literacy was first named by Paul G. Zurkowski (1974), it was the publication of the American Library Association's Presidential Committee on Information Literacy Final Report in 1989 that focused the information profession's attention on this concept. A few years earlier, the American Association of Medical Colleges had published "Physicians for the Twenty-First Century" (AAMC, 1984), which highlighted the need to develop students who were active independent learners and problem solvers rather than passive recipients of information. Just as the ALA defined the information literate person as one who had developed lifelong learning skills, the AAMC encouraged medical educators to re-examine both the priorities underlying the traditional content of the curriculum and the ways in which instruction was being delivered. As medical schools around the world began to revamp their programs, problem based learning was explored as a way to address the concerns raised by the AAMC report (Albanese & Mitchell, 1993; Donner & Bickley, 1993; Braunstein, 1997/1998).

Problem based learning is a student-directed active learning approach. Cases are presented in a small group setting, and students are encouraged to work in a collaborative fashion to identify and solve learning issues related to these cases. Two of the major goals of PBL are to enhance problem-solving and lifelong learning skills (Albanese & Mitchell, 1993; Barrows, 1985, 1986; Kaufman et al., 1985, 1989; Neufeld, Woodward, & MacLeod, 1989; Walton & Matthews, 1989; Wilkerson & Feletti, 1989). Medical educators expected that students who engaged in PBL would not only be able to solve the immediate problem, they would also develop the strategies and skills necessary to solve problems they encountered in the future. These students would have learned how to learn.

An examination of the goals of information literacy as defined in the ALA 1989 report revealed a number of similarities. The emphasis here is
also on problem-solving and lifelong learning. As the report indicates: "Ultimately information literate people are those who have learned how to learn" (ALA, 1989, p. 1).

These two parallel lines of thinking offered medical librarians an excellent way to incorporate teaching information literacy skills into the newly evolving medical education curriculum. Because students in PBL environments are encouraged to research and uncover answers on their own using resources outside the standard textbook material, they tend to make more use of the libraries associated with their schools. As a result, these students are more likely to need instruction in how to best access and locate the information needed to solve their PBL cases (Marshall et al., 1993).

A PBL curriculum, with its emphasis on individual problem-solving and self-directed learning, poses a multitude of problems for any library. Delivering appropriate and timely instructional support to a large number of students with a wide variety of information needs is particularly difficult given finite resources. UCLA’s School of Medicine began evolving toward a PBL approach in 1993 (Wilkes, Usatine, Slavin, & Hoffman, 1998). This new educational approach offered the library a unique opportunity to become involved in the early stages of curriculum development. Reference librarians at the Louise M. Darling Biomedical Library began working in partnership with faculty to develop an integrated cumulative library program that would be responsive to this new educational endeavor.

To ensure that the library’s collections and services would support this new initiative, meetings between the medical curriculum developers and the representatives of both the library’s collection development and reference divisions were scheduled. This gave the library the chance to become involved in curriculum development from its beginning. Furthermore, associating with this problem-based learning approach allowed the library to promote the idea of including information professionals among community resource experts who could assist students in their problem-solving endeavors. It also reinforced the link between information literacy initiatives and the goals being promoted by the new medical curriculum.

Finding a method to deliver appropriate and timely library support for student-developed objectives generated in a problem-based learning curriculum was particularly problematic. Because students generate their own questions, the library was faced with the necessity of developing an approach that would be generic enough to address a wide variety of topics and yet specific enough to respond to an individual student’s information needs. The variety of topics coupled with the fact that students do not meet in large groups made this a particularly difficult task. How could the library develop and deliver efficient effective support that anticipated students’ needs and at the same time enable them to develop lifelong
learning skills? In addition, how could the information be delivered to the students at their moment of need?

**Technological Solutions**

When PBL first began to be incorporated into UCLA's School of Medicine curriculum in 1993, the library responded by offering individual personal consultation hours with reference librarians. While this approach addressed the problem presented by wide-ranging questions, it quickly became clear that it was an inefficient way of reaching the large number of students involved. Only a small percentage of students took advantage of these consultations. The bulk of the students were still either trying to research on their own or were using the reference desk services as a means of dealing with their learning issues. Although the reference desk staff could and would attempt to assist the student with whatever specific problem he or she might have, we felt the students were not gaining the lifelong learning skills that are the goals of both PBL and information literacy through this approach. Clearly a different mode of instruction was needed that could be widely distributed to the students at their most pressing point of need.

The library's search for a new mode of instruction coincided with the campus' nearly universal acceptance of the Internet as a medium for communication and information dissemination. In 1994, librarians began using electronic mail to provide reference assistance that focused on specific cases assigned to groups of medical students. Other medical libraries as well have used electronic mail to supplement their reference services (Schilling-Eccles & Harzbecker, Jr., 1998). The first step in preparing e-mail reference assistance involved acquiring from medical school faculty a set of the cases students were working on with accompanying learning issues. Examples of these cases ranged from "substance abuse" to "breast cancer" to "tuberculosis." Librarians then developed a one-to-two page set of library hints based on the learning issues for each case. Examples of learning issues included diagnosis, treatment, and psychosocial components. The hints included information on how to locate relevant reference books, books in the general collection, and appropriate Medical Subject Headings to apply to MEDLINE searches. Where appropriate, librarians would include research and information retrieval concepts rather than simply "spoon feeding" the students with solutions. Working closely with faculty, two differing approaches were developed for first- versus second-year students: hints targeted for first-year students emphasized locating more general information typically found in textbooks, while hints targeted for second-year students emphasized more specialized resources such as the journal literature.

E-mail proved to be an efficient medium for library instructions. Furthermore, because librarians were already using e-mail routinely, a learn-
ing curve for this "new technology" was nonexistent. However, e-mail did present certain limitations. Because messages were sent out in advance of when students conducted their library research, reference assistance was often lost or deleted prior to when it would actually be useful. In addition, working within the confines of electronic mail (essentially an ASCII analog of the printed page) resulted in messages that were very linear and "step-by-step" in nature. Furthermore, limiting the information contained in a single message to a digestible amount necessitated the omission of a high level of detail. Thus, library support using electronic mail reaching students "just in case" as opposed to "just in time," offered no advantage over the printed page, and was not universally relevant to a wide range of knowledge and experience levels.

An ideal medium would facilitate the delivery of library support anytime the students needed it, as well as feature random nonlinear access to information of varying levels of depth and detail. The World Wide Web, which was in its early developmental stages at the time, presented itself as a medium holding great promise. Other institutions, such as the University of Utah Spencer S. Eccles Health Science Library, Johns Hopkins University William H. Welch Memorial Library, and the University of Florida College of Medicine, have also turned to Web-based educational programs (Hrinya Tannery & Wessel, 1998; Schell & Rathe, 1996). The Web, with its hypertext navigational schema, made it possible to present an easily digestible amount of information on the surface, yet offered more in-depth detail should the student need or choose to seek it. Because the actual instructional content resided on a server, it was accessible to students from home or library computing facilities. Furthermore, the graphical capability of the Web offered exciting and creative options not previously available using electronic mail.

After gaining proficiency in HTML, graphics applications such as Adobe Photoshop and Illustrator, and Web site design, librarians began developing instructional content. Initial Web projects involved taking existing printed handouts available in the library and manually converting them to HTML. The conversion of these documents took an inordinate amount of time, and the end results did not offer much advantage over the printed handout. A more cost-effective approach would have been simply to convert the documents into Adobe PDF files.

Creating instructional Web pages up to this point involved taking materials designed and destined for print and converting them to HTML. To exploit fully the strengths of the Web, however, it was necessary to completely rethink how visual instructional materials were designed and abandon the mental constructs applied to creating printed pages. Breaking away from the paper realm and arriving at what we felt were effective design principles for Web tutorials required some trial and error. As an example, a printed tutorial on searching the MEDLINE database was
converted to HTML. The paper document lent itself nicely to hypertext since it consisted of step-by-step instructions. A simple numbered list of topics (e.g., "how to do a keyword search," "how to refine a search," "how to expand a search," and so on) appeared on an opening page with hypertext links to other pages containing the actual tutorials. This appeared to be a vast improvement over initial efforts: embedded throughout each of the pages were one or two cross-reference links to other relevant pages, and graphics helped students visualize what an actual search session might look like on the computer screen. However, the Web pages still resembled their paper ancestor. While users could select topics randomly from the numbered list, the structure and presentation encouraged a linear predetermined path throughout the site. In addition, to minimize the number of individual pages that needed to be created and interlinked, the density of text on each of the pages was increased, making scrolling to relevant information cumbersome.

The process of working on these initial projects led to the realization that it is important to avoid emulating courses taught in the classroom when creating Web-based tutorials. Information in the classroom is usually presented in a pre-determined sequential order; to do so on the Web would undermine one of its primary strengths—random access. It is difficult to predict the point of entry a user might use to access a series of Web pages; therefore, the content of each page should stand on its own and not be dependent on a contextual relationship to other pages in a series. Furthermore, the comprehension of information should not be predicated on the place it holds in a sequential order of presentation. Rather than creating a series of pages with hypertext links from navigational phrases such as "next step" or "previous step," it is more effective to create links from important terms or concepts requiring further elucidation. Also, pages that are rich in links are more effective than those that are dense in text. Hypertext can empower users to seek more in-depth information on a particular topic and free them from scrolling through line after line of irrelevant text to arrive finally at the kernel of information that fills the gap in their knowledge. While such a design principle might be more labor intensive, the resulting pages will be more useful to a broader group of users with a wide range of knowledge and experience levels. More importantly, the inherent nature of a hypertext medium is in line with independent learning behavior.

Much experimentation led to the application of an "object oriented" approach to designing and planning Web-based tutorials. The term "object oriented" is borrowed from the programming world and (in a very simplistic definition) approaches the creation of large programs (or Web sites, in this case) by breaking them into many smaller self-contained modules or objects, each performing a specific task. A similar approach can be used for developing instructional Web pages. If an object-oriented
(as opposed to linear) approach is used, the creation of each new subse-
quently tutorial will require less time and effort than the previous, because
many tutorials will share similar topics or concepts; links to previously
created modules covering recurring topics can simply be embedded in
newly created tutorials. The only time that it is necessary to create a com-
pletely new page from scratch is when a new topic not previously covered
surfaces. A synergistic effect emerges from employing this technique, where
each completed series of pages acts as "seed crystals" around which other
new pages may grow. Eventually, a "critical mass" of Web pages covering
various topics will be attained. Librarians can then draw on this collection
when creating new tutorials on different, or similar, topics.

INSTRUCTIONAL CONTENT DEVELOPMENT

Deciding on the Web as the primary mode of delivering instruction
necessitated a rethinking of how best to organize instructional content.
Of most concern was the balancing of the "just in time" versus "just in
case" approaches. The library hoped to design Web pages that allowed
users to develop quickly strategies for answering specific questions at the
point of need. In addition, librarians wanted to provide more detailed
instructional material for learners who wished to develop more global skills.

The first step was to look at the type of questions typically posed by
medical school students and try to categorize these into groups or themes.
In consultation with medical school faculty, the following categories were
identified: diagnosis and treatment; ethical and legal issues; psychological
aspects of health and disease; statistical and epidemiological matters; so-
cial services; and health promotion, health education, and illness preven-
tion.

A Web site called "Finding Basic Clinical Information" (FBCI)
[http://www.library.ucla.edu/libraries/biomed/clinicalinfo/] was then de-
veloped. The site is composed of pages that combine information about
specific resources, both print and electronic, with some basic strategies
about how to use those resources, thus allowing students to meet their
just in time needs. Links to more detailed instructional Web pages for
those who wish to further develop their information literacy skills (just in
case) are also provided.*

These pages have been particularly well received by the School of
Medicine faculty. The work on these pages has profoundly influenced the
way Web-based instruction in general is developed and delivered. In par-
ticular, it has resulted in a revision of the library segment of the School of
Medicine's Foundations Program (the first year medical students' orienta-
tion experience). During the orientation sessions, the students are pre-

tained with their first problem based learning experience. They are given
a case to discuss and are led through the process of working with a group
to identify issues and generate questions. Students are then expected to
spend some time in the library researching the answers to these questions.

The students all attend a 45-minute session in the library during which the librarian leads them through the process of matching resources to their questions. In collaboration with the orientation faculty, librarians have developed a session that demonstrates how the library and its resources support the problem based learning style of learning and models the information-seeking behavior the students need to use. As part of the session, librarians show the students the special Foundations Web site [www.library.ucla.edu/libraries/biomed/foundations/index.htm] and model how to use it for their case. These pages are similar to our FBCI pages both in content and approach. Like the FBCI pages, the orientation pages are divided into themes or categories of questions and provide both just-in-time information and links to additional just-in-case instruction.*

The orientation sessions are brought to a close by indicating some of the other Web resources available through the Biomedical Library Web site. These include a list of standard medical textbooks available on reserve in our library and available through subscriptions to MDConsult and Stat!Ref, online tutorials, and the many journals, textbooks, and other full-text resources available to them. The goal of these sessions is modest: to alert the students to what the library has to offer and to encourage them to visit the library's Web site when they are in need of assistance. The orientation sessions are viewed as a means of promoting the distance education potential of the library's Web site and a way to demonstrate how these pages could be of use as a support of students' PBL experiences. More in-depth specific course-integrated instruction occurs at points in the curriculum where there is a specific course-related need to acquire additional information literacy skills. For example, a Web tutorial on searching PubMed (MEDLINE) was developed for the Human Biochemistry and Nutrition Laboratory course taken by first year medical students [www.library.ucla.edu/libraries/biomed/bc204/]. The Web tutorial supplemented an in-class lecture that covered the same material. However, since the Web pages are always accessible, students can use them any time they need to review this information or wish to develop additional information literacy skills.

In many ways, this approach, which is reflected in both the Finding Basic Clinical Information (FBCI) pages and its Foundations counterpart, fits in nicely with the adult learning theory basis of the medical curriculum. The students are viewed as active responsible participants in the learning process and are allowed to choose what to learn and when to learn it (Wilkes et al., 1998). Using the Web as the mode of delivery allows students to access the information any time, from any computer with Internet capability. So when students are motivated to learn and/or need to discover some specific information, the help they need is readily available.
to them. It is the authors' hope that this design appeals to UCLA medical students. We believe it encompasses the best of both worlds by providing answers to their immediate information needs, and the opportunity for continued growth and development of their lifelong learning skills. Furthermore, since these types of information literacy skills are incorporated into the medical school's curriculum competencies [www.medsch.ucla.edu/som/gradcomp.htm], the relevance of what the library is teaching is further reinforced. Of particular concern are such competencies as:

- the ability to identify and use reliable authoritative sources of medical information;
- the ability to use computer-based techniques including specified online databases and peer reviewed medical journals to acquire new information and resources for learning;
- the ability to organize personal resources efficiently and systematically using electronic tools and other methods; and
- the ability to understand the importance of lifelong learning to care adequately for patients, to participate in patient education, and to pursue creative scholarly endeavors.

**Lessons Learned**

Keeping up with the changes in the UCLA School of Medicine's curriculum and the methods being used to present this material has been an exciting and challenging experience. More changes and more challenges are anticipated in the future. A good faculty is always looking for better, more effective, ways to teach, and the UCLA School of Medicine faculty is no exception. However, it is clear that more and more information technology will be incorporated as a means of delivering and supporting instruction. Medical school students are now required to have their own computers, and many classes have computer-based components built into the course work such as online discussion forums, case presentations, practice exams, laboratory exercises complete with pathology slides, copies of PowerPoint presentations from classroom sessions, and student online evaluation feedback forms (these examples were collected from a review of the 2000-2001 courses listed at the UCLA School of Medicine site and are restricted to current UCLA School of Medicine Faculty and students).

So the pedagogical and Web design skills, knowledge, and abilities that librarians have developed should allow the library to continue to provide a program of integrated and appropriate instruction. The World Wide Web has broadened the library's ability to deliver information to library users. It has also challenged existing ideas about the ways information is organized and structured. The Web and its ever changing, ever growing, nature has also created a fluid work environment. This is both frustrating
and exciting. The bad news is that efforts must be constantly monitored and re-adjusted to keep current with the times. The good news is that this fluidity challenges librarians to grow along with it, and to develop different ideas that take advantage of these new options. Web pages, therefore, are never done. They should be responsive to, and reflective of, changes both in the information technology arena and in the users’ information. The authors view current and emerging technologies such as Macromedia Flash, WebCT, Internet Relay Chat, Allaire’s Cold Fusion, and so on as exciting possibilities for developing additional instructional approaches that will appeal to a wide variety of learning styles and information needs. The reader is invited to visit the UCLA Louise M. Darling Biomedical Library’s Web site [www.library.ucla.edu/libraries/biomed/] to see the evolution of efforts to provide Web-based support to UCLA School of Medicine students.

NOTE

* Neither the FBCI nor the Foundations pages are currently available from the Biomedical Library’s home page. Both pages have been superceded by a subject guide entitled “Resources in Medicine” available through the “Learn” tab on our home page or directly at http://www.library.ucla.edu/libraries/biomed/litreview_med/index.html.

REFERENCES


