Undergraduate Instruction and the Internet

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ABSTRACT
TODAY'S UNDERGRADUATES VARY GREATLY in their information and computer skills. Few are motivated, or even see the need, to improve these skills yet are excited and curious about the information superhighway. Several projects which integrate the Internet and specific Internet resources into undergraduate teaching and learning and the problems involved are described.

Few technology-oriented undergraduates have not heard of the information superhighway. From what they read and hear, students believe that taking the wheel is simple. They are frequently unprepared for the complexities of the network, the difficulties with equipment and connections, and the overwhelming amount of relatively unorganized information. Students, particularly those with little computer experience, may run off the road quickly due to sheer frustration despite their competing desire to be an Internet cruiser. Librarians and faculty members who are having students use Internet resources are still grappling with the best way to assist them. This article will describe activities which may assist student learning.

Using the Internet involves several types of activities (Abernathy, 1993) including electronic mail (e-mail), obtaining text or software from online libraries (FTP), real-time roundtable chats (IRC), mail groups (listserv, usenet groups, newsnet), and browsing gophers or World Wide Web (WWW) pages to find specific information resources and searchable

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databases. It is this latter activity in particular—finding useful information on the WWW—which has expanded academic libraries beyond their physical walls and rapidly drawn librarians into teaching students Internet skills.

Although students may have used e-mail or played games on the WWW, these activities do not prepare them for using the Internet to meet specific information needs. The Internet operates by very different rules from other electronic information systems which students may have previously used. The Internet has no physical shape or boundaries. Unlike a printed resource, it is not static but constantly grows, and the speed of these changes can be instantaneous. Although a resource present today may disappear the next day, students do not realize that the information keeps changing.

Currently, the Internet is a common resource where there is an egalitarian spirit and an attitude that anything goes. Information added to the Internet is not reviewed by a publisher or a librarian as printed articles and books may be. Students, unaware of these invisible filters of the information they find in libraries, may not realize what is missing on the Internet. Instead, they view the Internet as just a bigger and better library and a way of avoiding the apparent complexities of modern libraries.

Undergraduates have made the transition from card catalogs and printed indexes to online public access catalogs (OPACs) and CD-ROM periodical indexes relatively quickly due to the media hype of the need to adopt the new technologies. Having seen automatic teller machines (ATMs) replace bank tellers, and computer games replace board games, they view OPACs and CD-ROM indexes as just bigger and better electronic versions of card catalogs and the *Reader's Guide*. Despite the efforts of bibliographic instruction librarians, few students have learned the intricacies of keyword searching and Boolean logic or understand the reasons for evaluating the information found. After all, putting a simple topic into a computerized resource results in large quantities of information, and one can find what is needed within that group of information. For most undergraduates, these crude research methods have sufficed for their needs until they try to transfer their simple skills and mental model to the Internet. The difficulties of quantity, and the varying quality, of information, together with the problems of connecting and finding information, have become obstacles for undergraduates.

Gates (1993) offers the example of a Professor Jones who wants to make a document available. Jones does not need to clear this with any regional, national, or international organization. In fact, he does not need to tell anyone it is there. With the appropriate computer knowledge, anyone with an Internet connection can, and does, add to this information pool. The ease with which information can be added also

makes changing or correcting online information easy. Simply trusting that an Internet document is accurate may not provide the complete story. For example, on February 11, 1994, the Associated Press reported that the electronic version of a widely circulated White House press release criticizing a scholar's article on the Clinton health care plan had been altered. The initial press release used the word "lie" four times while the electronic version did not. The White House explained that they reserved the right to edit as all online authors can (Associated Press, 1994).

If anyone with an Internet connection can make almost anything available, sorting good (useful, relevant, reliable) information from bad (unreliable, false, extraneous) also becomes a problem. At a time when both education and business are emphasizing productivity, spending hours determining the reliability of information is not profitable.

Trying to find specific and useful information is complicated by the vast quantity of information on the Internet. If Jones had published his document as a book, he would probably have been asked to provide an index for the manuscript. Once the book was reviewed and purchased by a library, his document would be indexed in the library' s catalog as well. On the Internet, there is no comprehensive index or easy way to retrieve specific information. Alley (1992) writes: "There is lots of very useful information floating around on the Internet and without organization and structure it will get lost" (p. 1). Indexing a global resource is an overwhelming task. In the past, librarians have developed classification systems, cataloging formats, and controlled vocabularies to organize print materials, but computer scientists have developed Internet tools such as Gopher, Archie, Veronica, and World Wide Web. Krol (1993) states that each one of these [Internet tools] solves a part of the problem, but none has gone far enough or become widely enough used to solve the general problem of resource discovery, selection, and access (p. 6). Librarians are claiming their expertise and moving to tackle this massive indexing task. In a press release on April 7, 1995, OCLC announced that they will produce NetFirst, a comprehensive database of Internet accessible resources. An initial file of approximately 50,000 records will be introduced in the summer of 1995. The database will be created using a combination of automated collection and verification techniques and conventional abstracting and indexing practices.

Another librarian-initiated project has been announced by a Columbia University librarian, Magier. Collection development librarians at New York Public Library and Columbia, New York, and Rutgers Universities will explore, categorize, and evaluate Internet resources in eight fields: area studies, art and architecture, business, history, literature, music and performing arts, science, and social science. True to the library tradition, the results of this collaboration will be shared throughout the Internet (Jacobson, 1995).

For beginning users, the Internet is not yet user friendly. It will continue to grow and, in at least the near future, indexing or other software tools will not greatly assist users in reducing this volume. Many professors and librarians, while exploring the Internet, have discovered their personal favorites. Wanting their students to become familiar with this tool, they demonstrate the system and include an assignment in the syllabus. Students, having perhaps merely watched a proficient Internet searcher hit all the right keys, are given a list of questions for which they need to find the answers by Friday. Their initial problem may be as basic as not knowing how to connect easily to the Internet. Some undoubtedly have never had a computer account. Others will find it difficult to find an available computer in a laboratory. All of them will probably feel the immediate pressure of having to find the answers; that becomes their only goal. Few of them will have time to think about the system or the process they are being asked to learn.

The authors conducted an informal survey by asking for information on undergraduate uses of Gopher, WWW, or network information systems on several listservs in September 1994. Use of e-mail, listservs, or newsgroups was excluded from consideration. Of the ten responses received, five were from librarians, four from faculty in other departments, and one did not indicate his affiliation. All uses involved student projects as part of a specific course with subjects that included education, biology, Chinese Buddhism, engineering, business, history, international relations, and freshmen seminars. Although it appeared that one or two assignments were more focused (i.e., students were directed to a specific site), most were of a scavenger hunt nature designed to introduce students to the resources of the Internet. Specific objectives included learning to navigate the Internet and to access information sources, examining a range of databases and information services available, and providing tools that assist entry to remote systems. Nearly all responses mentioned that difficulty with connections caused student frustration and resulted in two projects (one in international relations, one in engineering) being considered failures by the instructors. In contrast to the Internet, other electronic information systems which students are familiar with seem much easier to connect to and use. Today's OPAC systems are up 98 percent of the time and simply rebooting a CD-ROM that has hung up simplifies the need to find the exact cause of the failure. In contrast, the Internet's multiple connections, and thus multiple places for failure to occur, create frustration and take control away from the user. This is only exacerbated by an assignment with a deadline—and by crowded computer facilities.

A similar Internet assignment at Purdue University received a mixed response. As part of the course, Emerging Communications Technologies (Communications 435) taught by Tuan-yu Lau, eighty students sent e-mail messages and completed an eight-question Internet hunt

assignment using the libraries' THOR Plus gopher system. In Fall 1993, the class was 84 percent seniors and 64 percent female. Few of the students had used computers before in their studies, as evidenced by one-third of the respondents rating their own knowledge and use of computers as low to none (34 percent) on a four-point Likert scale. Only nine students (11 percent) rated themselves as good. Responses to questions regarding their level of anxiety about e-mail and using a gopher before and after their class assignments indicated that instruction and hands-on experience did increase comfort levels. Of the responses, 96 percent recommended that future students in the course be given a similar assignment (T. Y. Lau, personal communication, December 10, 1993).

Most of the students found the assignment beneficial and fun. Many appreciated the opportunity to learn about the new technologies and only wished it had taken place earlier in their undergraduate education. They were impressed, but also frustrated, by the mind-boggling amount of information available. Many were annoyed at the cryptic menus and the time needed to search through submenus. They felt that the process would have been even more difficult if they had not been looking for answers (a recipe, weather report, job announcement) to specific questions. Although they had received instruction on using Veronica, students needed additional help from the laboratory assistant to find appropriate sites to answer questions. Searching for guidance, one student compared himself to a rat lost in a maze. He felt that if one did not find the right set of menus, one could not find what was needed, and that perhaps an Internet map would be helpful. Having read about, and discussed in their class, the new information technologies, students also were aware of the problems of quality and authenticity on the Net; they reported the frequent discovery of junk mail and difficulty in identifying authorship.

As availability of Internet access and media coverage increases, significant new demands have been placed on libraries to provide training. In 1992, Pengelly and Brown wrote that "if or when instructors start using the Internet as a teaching tool, we may get a demand for instruction that far exceeds our capability to provide it" (p. 186). Instructors have started using the Internet as a teaching tool, and librarians have responded by developing seminars, workshops, and courses (Pengelly & Brown, 1992; Rockman, 1992, 1993; Silva & Cartwright, 1993; Page & Kesselman, 1994). However, as Ensor (1994) describes, "there is no easy path to understanding it [the Internet] that will work for everyone. Even those familiar with the basics of the Internet may find it difficult to find information on specific topics" (p. 9). Just as the Internet is complex, instruction on its use on an individual campus can be complex. Access by individuals can vary from direct connection to dial up. This seems to be a primary obstacle for undergraduates. They are often unskilled computer network users and need specific support to learn to access the system. Any instructor needs to keep this as simple as possible.

Currently, our expectation to have students discover and use many resources of the Internet during one short seminar, or after a demonstration, may be unrealistic. Just as the Internet is an evolving system, so too must an individual's knowledge of its use evolve. Page and Kesselman (1994) point out that learning Internet skills seems to follow a natural progression from use of e-mail, to FTP, to the use of search tools such as Gopher and WWW. Librarians, although experts in information retrieval, have found that, when it comes to the Internet, sometimes they cannot "do it all." Instead, librarians are finding their role to be one of a guide or consultant. At Indiana State University, nine librarians and a systems staff member formed a team to answer information systems questions from faculty. The Internet became such an important aspect of the team's role that now all librarians are recognized as consultants for other faculty learning to use the Internet (Davis et al., 1995).

For many years, bibliographic instruction in academic libraries has emphasized the teaching of broad concepts rather than instruction in using specific reference sources or tools (Wilson, 1992) and the transferability of these concepts or strategies to other information resources such as the Internet. To be successful Internet users, students must have a clear understanding of the broad context of the Internet and its relationship to other electronic systems. Beyond the computer skills required to use the system, students still need to be able to use the same basic information literacy skills librarians have stressed in the last decade. Students must be familiar with what can be expected from the Internet, how to phrase their information needs, where to look for the specific information, how to structure their question, and how to evaluate the results. Just as critical thinking skills are needed to deal with the many choices of super catalogs, CD-ROMs, and other electronic media in libraries (Oberman, 1991), the same skills are needed to sort through, and evaluate, resources and information found on the Internet.

Undergraduates need to place the Internet in their mental model of information retrieval tools and develop proper strategies for fulfilling their information needs. Students must understand not only how to use the Internet, but also when it is appropriate and what problems they need to be prepared to deal with. A hands-on exercise, designed to build a mental image of using the Internet as an information retrieval technology, is the PLACES Game developed by Brandt (1995). Through role-playing, handouts, and online demonstrations, students learn how client server protocols used by Gopher and WWW work. While one student acts as the client and retrieves menus from other students (servers) in the classroom, the instructor discusses the amount and kinds of computers on the Internet and the functions of the client software used to retrieve menus and to organize the information for easy viewing despite hardware differences. Servers are described as holding stored information

until a request is made. Problems encountered, such as servers down for maintenance and connection difficulties, are explained. As the differences between browsing and searching are demonstrated through the results of a Veronica search, the concept of, and need for, evaluation is introduced. To illustrate a Veronica search for a keyword such as *rock*, each server (student) is given a pile of paper strips and told to give the client any that contain the word *rock*. The client then reads out a random sampling of items retrieved, showing the many ways the word may be used (e.g., rock and roll; rock climbing; Little Rock, AR) and the possible duplication of items. This begins the discussion of the need to evaluate the information retrieved. The students' need to have this larger view makes continuation of instruction in information literacy skills appropriate and critical. In many aspects, this evaluation is not any different from evaluation of print materials or information received from individuals, television, or radio (Janicke, 1995).

Students need to be able to evaluate not only what they find but also weigh the time and effort needed to find information on the Internet against its value. Several students in the Communications 435 class felt they could have saved time and obtained adequate results using another resource. Krol (1993) points out that currently a race between a good reference librarian in a good library and a person sitting at a networked terminal might easily be won by the reference librarian since network tools are not yet fast enough or easily usable (p. 6). In time this will change but, as the amount of information will continue to grow, students will find it even more difficult to discern what is important, making well-developed critical thinking skills necessary for success.

Currently, librarians find themselves in a dilemma as they try to balance students' desires to learn about the Internet and students' lack of evaluation skills to determine when the Internet is the best resource for an information need and if the information retrieved meets this need. Classroom activities and assignments need to be carefully designed to satisfy student interest and yet teach the needed skills. For example, a class on keyword searching and use of Boolean operators might include an application of the concepts to a library catalog accessible through the Internet.

Specifying a particular site that is already known to have relevant, well organized, and valuable information is one way to guide new Internet users and make their early experience rewarding. One skill librarians bring to the Internet is their knowledge of subject classification. Current Internet tools provide only a keyword search for information, and users must be aware of exactly what they are searching for. Kalin and Tennant (1991) discuss the need to use both formal and informal sources of information to identify available resources. They identify network information centers (NICs) and lists or catalogs of network resources produced by NICs or other organizations as formal sources, while informal lists are compiled by individuals to fill a specialized niche (p. 29).

Table 1 provides addresses for selected directories which identify Internet resources by subject or list new resources available on the Internet. Despite a lack of evaluation of information added to the Internet and inconsistent organization of what is available, individual Internet users are providing valuable subject approaches. Although such guides are only as good as the individuals doing them, they do provide another opinion and indicate some reliability of the source.

Amato's column, "Internet Reviews," beginning in *College & Research Libraries News* in February 1994, provides evaluative information. Recognizing the difficulty in identifying and assessing resources, this monthly column provides reviews that take a critical eye to resources available on the Internet (p. 89). In addition, a series of ongoing articles (Internet resources for . . .) in the same publication lists Internet sites for academia on subjects such as law, health and medicine, and economics (Jacox & Striman, 1995; Hancock, 1994; Morgan & Kelly-Milburn, 1994). Columns similar to "Internet Reviews" can be found in *Library Journal* (Internet@LJ by Polly and Cisler).

Another way of guiding use of the Internet for undergraduates as well as other users is by providing a simpler interface. In 1990, Binghamton University Libraries developed such a graphical user interface using X-windows and called it Internet 1. The Internet 1 menu has three choices: online library systems, utilities, and other Internet resources; each choice provides pop-up instructions when selected with a mouse. Each category offers a limited list of options selected by librarians to meet their users' needs (Perkins, 1994). This approach certainly improves user success but is only available on specific computers or systems.

Just as earlier library technologies caused new work groups to form that bridged both disciplines and administrative units on campus (Baker, 1991, p. 211), similar ties need to be made due to the Internet's complexity and widespread availability on campus. In some cases, librarians have teamed with the staff of an academic computing center to provide instruction (Kalin & Wright, 1994; Pengelly & Brown, 1992). Instruction responsibilities can be divided by having computer staff deal with connectivity issues while librarians handle the content and information resources available. Certainly, as we consider the complexity of the Internet, and the evolutionary nature of comprehending the Internet, coordination among the campus units developing undergraduate instruction can only benefit student learning.

In fact, integrating information and computer use throughout the curriculum appears to be an excellent, but difficult to achieve, way of assisting students in coping with a modern information-intensive society. Just as programs for writing across the curriculum have been developed, information literacy needs to be a part of all course work and emphasized

TABLE 1
DIRECTORIES OF INTERNET RESOURCES

Resource Name, Address, and Description	
The WWW virtual Library	http://www.w3.org/hypertext/datasources/bysubject/overview.html

The virtual Library at CERN is a cooperative effort maintained by many people. It employs a number of views; including a nested subject tree display and a display utilizing Library of Congress subject headings.

Network Information Center (Internic)	http://www.internic.net/

A collaborative project of three organizations, Internic offers a full range of information services. The Information Services menu item leads to many quality services. Infoguide is the "reference desk" for Internic.

Scout Report	http://rs.internic.net/scout_report-index.html

Scout Report, published by Internic, selectively highlights new additions to Internet information services on a periodic basis.

Best of the Best on the Internet	http://www.clark.net/pub/lschank/web/subject.html

Librarians' selections arranged according to subject.

BARD Selected Internet Resources	http://www.rsl.ox.ac.uk/bardhtml/selected.html

A selection of Internet resources made by the Bodleian Library, Oxford, UK. BARD offers a subject arrangement, a keyword search mechanism, and a title arrangement.

Info-filter	http://www.usc.edu/users/help/flick/Reviews/index.html

The Info-filter Project is a source of timely, accurate reviews of Internet resources.

University of Tennessee-Knoxville	http://www.lib.utk.edu:70/1/Information-by-Subject/

Selected resources are arranged according to LC classification

The Whole Internet Catalog	http://nearnet.gnn.com/gnn/wic/newrescat.toc.html

The Whole Internet Catalog, available both in print and electronically, is a subject guide to 1000 Internet resources published by Global Network Navigator (GNN) of O'Reilly and Associates. The online version is divided into easy-to-surf subject areas.

Yahoo's List	http://www.yahoo.com/

Subject list to thousands of Internet sites; lists other general Internet directories. Yahoo includes a search mechanism for locating specific resources on their list.

Clearinghouse for Subject Oriented Internet Resource Guides	gopher://una.hh.lib.umich.edu:70/ll/inetdirstacks/ http://www.lib.umich.edu/chhome.html

Collected from individuals worldwide by University of Michigan's University Library and School of Information and Library Studies. The full texts of the guides are searchable.

National Center for Supercomputing Applications' (NCSA) What's New Page	http://www.ncsa.uiuc.edu/SDG/Software/Mosaic/Docs/whats-new.html

The What's New Page is updated three times a week, with archives of past dates easily available from the menu.

by more faculty than just librarians. One of the most difficult problems for librarians today is getting students to see the big picture—i.e., that information skills are transferable and will be valuable all their lives. Students mistakenly focus on only the immediate (short-term) project and do not see it as a rehearsal or practice for projects in their future.

An example of such integration into the curriculum is the University of Washington's program for sixty-five new first-year students called UWired, which won the 1995 Association of College and Research Libraries, Bibliographic Instruction Section's Innovation in Bibliographic Instruction award (A. Bartelstein, personal communication, April 19, 1995; URL for Uwired homepage: <URL: http://www.washington.edu/uwired/uwired.html>). Three campus units, Computing and Communications, Undergraduate Education, and the University of Washington Libraries, are collaborating to integrate electronic communication and information navigation skills into teaching and learning at the university. The program brings together librarians, computing experts, faculty, staff, and students to focus on discipline-specific instruction about electronic resources and their applications in the classroom. The selected students are each given an Apple PowerBook computer to use and are participating in a year-long information technology seminar taught by university librarians. The students are part of three thematically linked clusters of classes in the University of Washington's Freshman Interest Group (FIG) program. All the faculty and graduate teaching assistants teaching in these courses are also involved in the UWired project and have received extensive technology training. The benefits for the faculty members have already been observed as they have had opportunities to talk with each other about class assignments and projects and thus complement each other and create interdisciplinary links for the students. The potential is also there for collaborative learning among the students (A. Bartelstein, personal communication, October 4, 1994; Monaghan, 1994).

Limited computer facilities often make it necessary for students to work together in groups on Internet assignments. However, this can be a positive teaching tool and, as new electronic classrooms are designed, many are planned to accommodate such collaborative learning. Having an opportunity to practice group communication skills, testing ideas with other students, clarify their thinking through discussion, and learning from new perspectives can increase student learning and retention (as computer anxiety decreases).

The golden halo surrounding the Internet is fading somewhat as both professional librarians (Crawford & Gorman, 1995) and Internet addicts (Stoll, 1995) write of their concerns about our electronic future. Presently, users are most concerned with how to connect and navigate the Internet, perhaps viewing it too much as an extension (bigger and better) of older technologies which it might replace. However, as emphasis

shifts to how users can really make use of the Internet (Connell, 1994, p. 609), we will begin more fully to integrate it into our information-seeking behaviors and teaching. It is difficult to predict how the Internet's continued use will shape our future, but it is a future in which academic librarians must be leaders.

Librarians, having already introduced students to computerized information systems, are poised to become campus leaders in coordinating and integrating Internet instruction into the curriculum. They can assist in facilitating campuswide coordination of Internet use and education by actively working with campus computer centers to provide systematic instruction.

Despite being described as the Nintendo generation, undergraduates are not automatically able to use the Internet. Problems with simply connecting can frustrate students before they have a chance to move to the point and click environment of Gopher or World Wide Web browsers. Librarians, with their knowledge of searching strategies, need to work with other teaching faculties to interpret Internet resources and guide undergraduates in effective use of networked information systems. The conceptual skills which bibliographic instruction librarians have been teaching remain vitally important, and emphasis needs to be placed on teaching undergraduates the importance of evaluating their information need and the information retrieved to satisfy that need.

Although future students may be better prepared to use the Internet, having already used networked information systems, colleges and universities will need to have the teaching interface in place to ensure that such skills are taught throughout the curriculum.

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