The Internet: Educational Issues

TSCHERA HARKNESS CONNELL AND CARL FRANKLIN

ABSTRACT

THE INTERNET CAN REINVIGORATE education and libraries, but this outcome is not certain. A key factor in achieving this goal is distinguishing between the technological content of the Internet and embedding it in a particular context. One useful context is information literacy. In addition, a number of other important issues must be addressed. These include the changing role of the Internet in the classroom, library, and workplace; the economic and geographic barriers to accessing the Internet; the implications of different privatization approaches; the impact of the Internet on professional school curricula; and the need for better tools and user interfaces. One additional concern should be the integration of Internet resources with the existing infrastructure of the nation's libraries and library systems. In short, educators and librarians must ensure that the evolving National Information Infrastructure (NII) reflects their needs and concerns. To do so, they must gain cooperation from the public and private sectors. The result may be an education revolution in which teachers and librarians help students develop the job readiness skills necessary to succeed in an information-intensive economy.

INTRODUCTION

One justification for the existence of the library is its role in the education of society (Reith, 1984). The Internet, an international network of networks, can open up new avenues of cooperation between educators and librarians as well as enhance the role of librarians as educators. As the Internet strengthens the links between

libraries and education, several issues will need to be addressed. These include changing roles in the classroom, library, and workplace; unequal access to the Internet; privatization of the Internet; professional school curricula; and tools and user interfaces.

Discussion of these issues should take into account how new technologies are dispersed among, and integrated within, organizations. Adopting a new technology creates ambiguity in both the organization and in the technology. The potential applications for a new technology may lead to an ambiguity in its definition and uses. Tornatzky et al. (1983) suggest that this ambiguity may be reduced by distinguishing between the "technological content" and "embedding content" of a technology (p. 5). The technological content includes the definition of what the technology is and what it does; the embedding content refers to the organization behaviors or processes that make the application of the technology possible.

At first the efforts to adopt a new technology are directed toward technological content: learning about the innovation, its potential, how to obtain it, how to use it, and how to incorporate it into existing structures and budgets. Currently this concern with technological content dominates the discussion of Internet applications in classrooms and libraries. The Internet is seen as an extension of older technologies—a more efficient and faster way of doing what was done before. However, as individuals and organizations increase their understanding of the Internet's technological content, its potential should become clearer. As educators and librarians gain experience in using the Internet for traditional purposes, they will begin to consider how it can reorganize the classroom; transform learning; and change information seeking, organizing, and using behaviors.

As users shift from a focus on technological content to embedding content, new applications will be developed for the Internet. Already academia and business are searching for ways to foster electronic collaboration among students, faculty, and practitioners. Collaboration benefits everyone because it promotes information sharing, guides learning, and helps integrate experience. As the economic and social benefits of the Internet become more clear, the public and private sectors will formulate new roles and rules for handling this valuable asset. Altering behaviors and policies is always difficult because the necessary changes are hard to predict. However, it is certain that embedding the content of new technologies will shape the future. Educators and librarians should consider how embedding the content of the Internet will affect their roles in society.

CHANGING ROLES IN THE CLASSROOM, LIBRARY, AND WORKPLACE

The most important factor in determining whether the United States will continue to be competitive in the global marketplace is

the improvement of education and training. Improvement will require the adoption of new technologies but this cannot be done in a haphazard fashion. Turkle (1991) cautions that the "computer's greatest promise as an educational aid depends on its use as a personalized environment for learning..." (p. 8). Adams and Bailey (1993) suggest the time has come to switch from traditional instruction, which makes little effort to engage students in information literacy, to Information Age teaching, which incorporates technology and information literacy throughout the curriculum. This switch will have a significant impact on the roles of students, teachers, and librarians. Its influence will also extend to the workplace.

Before discussing the impact of this change on roles, a brief examination of information literacy is in order. Cleaver (1987) defines information literacy as a set of skills and attitudes for lifelong learning. Information literacy is directly related to critical-thinking skills and emphasizes such activities as selection, rejection, evaluation, organization, topic definition, and question definition. Also, it covers such topics as the value of information, ethics of information use, and information consumerism. In short, information literacy seems a natural choice for embedding Internet technology in the classroom, library, and workplace.

Because information literacy makes different demands on the student than the traditional curriculum, the role of the student must be redefined. Bruner (1985) notes: "You cannot improve the state of education without a model of the learner. Yet the model of the learner is not fixed but various. A choice of one reflects many political, practical, and cultural issues" (p. 8).

Bruner (1985) discusses several models of the learner. Among these are tabula rasa, constructivism, and novice-to-expert. The tabula rasa model assumes that the mind is passive in that it reflects only what order exists in the world. The learner is seen as an empiricist whose knowledge structure is entirely driven by experience. Constructivism asserts that the world is not found but made through interaction with experience. The learner acts as a theorist who continually refines his own structure of knowledge based on experience. Finally, the novice-to-expert approach analyzes what experts do and trains novices to follow in their footsteps. The emphasis is on the practical steps needed to move a student from an initial understanding of a subject to an expert understanding.

Of the models discussed by Bruner, the constructivist approach may be the most complementary to embedding Internet technology and integrating information literacy with K-12 and postsecondary curricula. The constructivist model of the learner makes the following assumptions (Franklin, 1989).

Truth and reality are made, not discovered.
Learners are active epistemological agents.
New knowledge is processed in relation to existing knowledge.
Both content and context are important to learning.
Learning is a never-ending process, not a product.
The primary responsibility for learning rests with the student. (p. 51)

In the constructivist model, the teacher can no longer claim a monopoly on knowledge. This implies a student-centered classroom and not a teacher-centered one. As a result, the role of the teacher shifts from instructor to facilitator and coach. The goal of the teacher is to empower students. Empowerment is achieved through helping students improve their critical thinking and collaborative and integrative skills. It is also important to help students develop a sense of responsibility for their learning behaviors. Some of the skills needed are discussed briefly below

Critical Thinking Skills

Critical thinking skills include abstract thinking, problem solving, and inference. These skills have long been recognized as important, but now they are essential for learners in a student-centered learning environment.

One of the major difficulties in using information technologies is the problem of information overload. The quantity of information available calls for analytic skills in selection and evaluation. The ease of obtaining an answer may hide from students the need to sift through information for the best answer. However, finding the best answer requires defining what is best. Is it accuracy? Is it currency? Is it usefulness? Dervin (1977) sees value in information in terms of a process by which individuals combine external descriptions of reality with their own ideas, structures, or pictures of reality. In this context, the ability to evaluate information requires students to formulate some concept of the value of information (Cleaver, 1987).

Collaborative and Integrative Skills

Projects requiring teamwork are becoming more prevalent in the workplace. Among the situations calling for collaborative efforts are collective problem solving, group decision making, and collaborative design. Information technology is particularly well suited to supporting collaborative work. Specific skills needed to take advantage of the new technologies include good articulation (written and oral), the ability to work in groups, "modes of reasoning that are ... procedural and systemic ..." (Zuboff, 1991, p. 5), and an ability to understand how individual parts of a project fit together to achieve the success of the whole.

Integrative skills include the ability to synthesize different types of sources (oral, print, graphic, and typographic) and then organize the information for presentation.

Working Definitions of Responsibility

Cleaver (1987) stresses integrity as an important component of responsible scholarship and includes integrity as a needed element of a personal concept of information. However, if responsibility exists only in the context of responding to "what happens to one, to what is to be seen and heard and felt" (Buber, 1965, p. 16), then there are characteristics of computer innovation which may make responsible computer use more difficult. Friedman (1990) identifies three characteristics that have particular importance in the educational setting. First, with remote interactions, an irresponsible user may not fully know the consequences of his or her actions. The remoteness of the interaction diminishes the concept of a "victim." Second, with computers programmed to do more tasks, routine decisions are taken out of the hands of the user and the user can lose a sense of control of those tasks. As decision making is delegated to computers and team environments, it becomes more complicated to assess moral responsibility for computer use. And third, since computers are a relatively recent innovation, there are few agreed upon and pervasive social conventions governing computer use. Friedman suggests that one approach to helping students develop definitions of responsibility is to use student self-government to resolve issues of in-class computer use. This approach makes visible the consequences of computer-mediated actions so that personalized definitions of computer responsibility can take them into account.

Fostering these skills requires that educators create an environment in which multiple processes to learning are recognized as integral to the development of diverse ideas and products. What this means is developing activities that place students in charge of their own learning while they interact with existing knowledge. With respect to the Internet, teachers can set up exercises in which students exchange opinions on controversial subjects via e-mail, participate in online discussions and simulations, and conduct collaborative research with academic experts. Librarians can teach the use of resources on the Internet, design services that are customized to individuals or groups, and promote standards that support international sharing of information.

The critical thinking, collaborative, and integrative skills important for learning have also become essential in the workplace. Zuboff (1991) suggests that the obstacles to achieving innovation with information technology lie not in the technology itself but in the

persistence of nineteenth-century forms of organization and conceptions of management. These outdated approaches regard information as something to control—a source of personal power within the organization. Information technology can help shift the emphasis from control of information to sharing it. Zuboff observes that "information technology symbolically renders processes, objects, behaviors, and events so that they become visible, knowable, and shareable in a new way" (p. 5). In order for firms to stay competitive, management must use technology as a way to share information so that work gets done. This shift in the roles of the manager and worker parallels the shift in the roles of the teacher and student. The manager needs to empower workers. Because workers at all levels have more information available for decision making, they must have the information literacy skills to use that information effectively. Educators and special librarians can help foster those skills.

Within the context of societal demands, Hunter (1992) identifies several grand educational challenges that can be addressed by the Internet. These include meeting the needs of a multicultural population, reforming instructional methods and curricula to better meet the needs of diverse students within the context of an information society, forging closer links between the school and community, fostering collaborative learning, adopting constructivist views of learning, and continually updating curricula and teacher knowledge. The author warns that educators need to get involved now while the national telecommunications and information infrastructure is being designed and deployed. Otherwise, the resulting system may not reflect their needs or concerns. This warning applies equally to librarians and other information specialists.

Information Power: Guidelines for School Library Media Programs, a joint publication of the American Association of School Librarians (AASL) and the Association for Educational Communications and Technology (AECT), provides some guidance as to how the role of the librarian could change with an emphasis on constructivism and information literacy in K-12 environments. This vision of library service promotes collaboration between school library/media specialists and teachers in developing classroom activities. Technologies, such as the Internet and more traditional library tools, can play a vital role in creating classroom activities that develop information literacy and critical thinking skills.

School, public, and academic librarians have long based their service on a constructivist model of the patron. That is, the librarian already takes the role of facilitator and coach. The shift to integration of information literacy with the curriculum will require the librarian to place a heavier emphasis on the nature, value, and life cycle of

information when working with students. For example, the librarian can introduce students and teachers to Internet's basic services, show applications appealing to student interests, and help students create and disseminate information resources, such as newsletters, using the Internet. For many schools and libraries, however, access to the Internet must be achieved first.

UNEQUAL ACCESS

While there are an estimated 15 million users of the Internet worldwide (Southerland, 1993, p. f1), this group represents a narrow elite. One dissertation in progress indicates that the majority of Internet users are academics, scientists, and engineers (Brandon, 1993). This must change in order for the Internet to achieve its full promise. The greatest barriers to the Internet are economic and geographic.

In 1989, about 13 percent of the U.S. population lived below the poverty line (CENDATA, 1990). Children make up about 40 percent of this group and the elderly, about 11 percent (CENDATA, 1990). Nearly half of the poor family householders (49 percent) never worked at all in 1989 and only 17 percent worked full-time throughout the year (CENDATA, 1990). Thus, most of the poor do not have free access to the Internet through an employer. They must pay for access through a service like Prodigy or do without. The challenge is not just overcoming the inability to pay for access but also the inability to afford the necessary computer equipment and the training to use it. The public library is one of the few institutions capable of addressing this problem. As yet, however, only a few hundred U.S. public libraries are connected to the Internet, according to Stephen Wolff at the National Science Foundation (Bajak, 1993, p. E4). Making the Internet an integral part of service at all public libraries will require substantial assistance from the public and private sectors.

The second major barrier to equal access is geographic. According to the 1990 census, 75 percent of the U.S. population lives in urban/suburban areas and 25 percent in rural areas. Most telecommunications nodes are based in urban areas. Coupled with evidence that deregulation has removed incentives for telecommunications companies to serve rural areas, a serious question arises about the ability of rural users to link into the Internet ("Bringing the Information Age...," 1993). Of course, it is possible for rural citizens to dial long distance to connect to the Internet, but this assumes that rural users have touch-tone service. Even if touch-tone service is available, many future Internet services, such as compressed video, will require a higher bandwidth than twisted pair lines can carry.

Rural areas are destined to be among the last to get fiber optic lines unless the federal government installs them or provides incentives to the telephone and cable companies now serving rural America.

Dillman and Beck (1988) point out the vital need for a telecommunications infrastructure in rural areas. Without this infrastructure, rural areas will not be able to compete against urban areas in the growing information economy. In addition, the authors note that rural workers are generally less knowledgeable about information technology than their urban counterparts. Thus, rural workers share some of the same problems as the poor.

Those who are both rural and poor face the greatest barriers to using the Internet. In 1989, about 16 percent of those living in nonmetropolitan areas were poor versus 12 percent of those living in metropolitan areas (CENDATA, 1990). This is not a small problem. The 16 percent translates into millions of Americans who will have no access to the National Information Infrastructure (NII) for the foreseeable future. The rural poor represent a major test of the Clinton administration's commitment to universal Internet access.

There are positive signs of collective efforts to address these problems. The purpose of what may become the first annual Rural Datafication Conference (Chicago, May 1993) was to promote "ubiquitous access to the Internet" (Cady, 1993, line 4). The conference was sponsored by the ClCNet and nine cooperating state communications networks or organizations: netILLINOIS, INDNet, IREN, MichNet, MRNet, NYSERNet, PREPnet, WiscNET, and WVNET. More than 200 people from all over the United States and Canada attended the conference. Sessions were devoted to government networking, legal and policy issues, and building on the experience of community access television specialists. Discussion groups were held on such diverse topics as ways that networked information can be used to address the preservation of Native American cultures, the needs of agriculture, the roles of libraries, K-12, and post-secondary education. However important this event, it is a small beginning. The obstacles to universal access are many, and it will take a mammoth concerted effort by all segments of society to overcome these.

Failure to provide access to the Internet for needy rural and urban groups may exact a high price. No less than the democratic and economic future of the country is at stake. The Clinton administration's own "National Information Infrastructure: Agenda for Action" reiterates Thomas Jefferson's statement that "information is the currency of a democracy" ("National Information Infrastructure," 1993, p. 11). Citizens cannot participate effectively in a democracy without information, and the Internet may become the single most important source of information. Yet access to the Internet is

not enough. Citizens must have the skills to seek out and use information effectively. This makes information literacy a critical ingredient of democracy.

Access to the Internet is important for economic reasons as well. The majority of jobs in the United States are information based (Rubin, 1983). This is not likely to change in the near future. In fact, it is virtually certain that the information component of work will intensify. This may lead to the Internet becoming a vital tool for business. One projection indicates that the Internet may reach 50 million business users by the year 2000 (Nelson-Rowe, 1993, p. S-57). The result may be that those without access and the skills to use the Internet will be unable to compete in the national information economy. Those who fear this outcome are pushing the federal government to take a larger role in the development of the Internet. Others believe that the Internet should be completely privatized.

Privatization

The Internet privatization debate involves three different approaches to information. These are the resource, commodity, and social control approaches (Mosco, 1989). The resource view regards information as an economic asset with two main forms: public and private. As a public asset, information is owned by all and every citizen has equal access. As a private resource, information is either owned by an individual or owned by an organization. Currently, the Internet encourages the perspective of information as a public resource. The commodity approach views information as a private good that can be precisely defined, measured, and exchanged. This approach is the direction in which the private sector would like to take the Internet. The last approach, information as a means of social control, looks at information as a way to manipulate society and restrict individual freedom. Mosco (1989) concludes that American society is dominated by the commodity approach and our implementation of this approach may lead to information as a means of social control by large corporations. The most desirable choice for the Internet may be the full implementation of the resource approach because it balances the interests of the public and private sectors. Under this arrangement, all K-12 and postsecondary schools would benefit from the public resources, and additional private resources would be available to those with the ability to pay.

Another part of the debate over privatization of the Internet involves the amount and kind of government regulation. The regulatory environment of the Internet will have a major impact on freedom of speech and other intellectual freedoms. There are at

least four regulatory models from which to choose. These are the print, common carrier, nationalized broadcast, and regulated commercial broadcast models (Gorka, 1993). The most familiar model, that of print, is protected by the U.S. Constitution. In the print model, the Internet is seen as both a printing press and a soapbox. There would be very few restrictions on what could be published or said short of libel or slander. Some even suggest the need for a constitutional amendment that would specifically extend print-based rights, including copyright, to the electronic sphere. However, others have argued against copyright as an artifact of print technology. This point of view notes similarities between electronic medium and oral cultures where much of the communication is informal and the sharing of ideas is a communal free exchange. Brent (1991) points out that "[a] crucial difference between oral and literate diffusion of knowledge is that, as knowledge diffuses through knowledge networks or modern research disciplines, it leaves behind the tracks of its passage in the form of earlier texts linked by webs of citations" (Brent, 1991, lines 196-199). In modern societies, authors retain ownership of the ideas at the same time they release them to the world—"in a sense leasing rather than transferring them to others" (line 207).

In the next model, the main concern is not intellectual freedom but access. Here the Internet is seen as a common carrier similar to the post office or telephone company. The Internet would be regulated as a monopoly for the public good. Access to the Internet would be guaranteed for a minimal price but there would be restrictions on certain types of content such as obscene matter. This is the model currently favored by the Clinton administration.

The two broadcast models would draw an analogy between the Internet and other mass media such as radio and television. The nationalized model would place control of the Internet solely in the hands of the government. While this would eliminate commercial advertising, the dangers of information as a means of social control make it an unacceptable choice. The regulated broadcast model would place the control of the system in private hands with government oversight. This approach might result in low quality programming like that found on the three national television networks.

Gorka (1993) concludes that the print model is best for the Internet because it promotes diversity and protects intellectual freedom. For librarians, this has substantial appeal. From an education standpoint, however, the common carrier model is most desirable because it guarantees universal access.

While useful, the four regulatory models discussed do not provide a full picture of the privatization debate. This is because ownership

of the Internet is distributed among many different groups and nations. Nonetheless, the players may be characterized as belonging to either the public or the private sector with a corresponding emphasis on information as a resource or a commodity. While ownership of the shared Internet will always be by public and private interests, the balance seems to be shifting in favor of the private sector. If this trend continues, more parts of the Internet, such as the NSFNET, may be turned over to the private sector. In addition, cooperative efforts among businesses may lead to the expansion of services like the Commercial Internet Exchange (CIX), which work around government restraints on business uses of the Internet. The danger is that unrelenting privatization of the Internet may destroy the spirit of sharing that forms the basis for USENET and other free services. Changes in professional education are needed to ensure that future educators and librarians are able to foster and extend the Internet's philosophy of sharing information and expertise.

CHANGES IN PROFESSIONAL CURRICULA

Hunter (1992) notes that the national telecommunications and information infrastructure can be a tool for promoting educational reforms. In order for this effort to be successful, educators and librarians, both present and future, must learn about the Internet and its applications. Dinham and Stritter (1986), in their review of research on professional education, conclude that the technological education of students has received far less attention than it merits. Therefore, there is little research to guide efforts to incorporate the Internet into professional education. The discussion begins with a focus on incorporating the Internet into the professional programs of educators and librarians. The second part will cover continuing education. The final part will consider the need to fund these changes.

Education faculty from all areas should integrate the Internet within their courses, but one area should assume the responsibility for teaching an introduction to the system. The most logical area to assume this role is instructional design and technology. This area also happens to be the one which often serves as a home for the school library/media program. Instructional design and technology is a logical choice because it has most of the expertise and facilities needed to integrate the Internet with the curricula of other programs and departments within a college of education.

Dinham and Stritter (1986) also point out the need for a clinical or apprenticeship component in professional education. For education majors, this means spending time student teaching under the supervision of an experienced practitioner. The practitioner should have a commitment to constructivism, collaborative learning,

and use of the Internet in the K-12 classroom. This commitment helps the practitioner model appropriate behaviors and successfully guide the student.

Like colleges of education, schools of library and information science should integrate the Internet throughout their curriculum. At the least, all students should be required to take a course which introduces them to the Internet and its applications in libraries and information centers. Leadership may come from the information science and technology faculty, but the entire school should be committed to the effort. In fact, the Internet makes its possible to combine the strengths of both traditions. For example, students of an advanced cataloging and an advanced technology class can work together to build an electronic discussion group to address issues of organization of information for access in an electronic environment. The management and the policies of the group can be accomplished by teams. One team can be concerned with the technical aspects of getting the discussion group established, another can propose policies to govern participation, another can be concerned with indexing, another with screen design. Discussions can involve issues addressed by the teams, but the primary purpose of the discussion group would be to address broader professional issues. One such issue might be the effect labeling has on online catalog displays, both on the user's understanding of bibliographic displays and on international standards for data exchange. Ultimately, it may be useful to consider a school's success in integrating the Internet and other technologies into its curriculum as part of the reaccreditation process.

The kind of interaction discussed earlier can be carried on among classes within a school of library and information science, among disciplines such as education and library and information science, among main campuses and branch campuses, and among universities. The joint learning experience addresses not only the technological content but also the embedding content of the Internet. Students must learn to work differently in electronic collaboration and teamwork in addition to using the Internet as a vehicle for discussion.

Many schools of library and information science offer practica and internships. Like clinical programs for educators, these should be structured so that the student gains an understanding and appreciation of the practical aspects of using the Internet in a particular setting. For example, the practicum supervisor should show the relevance of the Internet to technical services and how it serves the needs of patrons.

Making the Internet part of continuing education programs for educators and librarians is critical. In order to continue their certification, K-12 teachers must take a certain number of continuing

education credits over a set period of time. A strong argument can be made that a portion of these credits should be set aside for teachers to learn about new technologies, such as the Internet. In the case of librarians, there are no widespread certification requirements. This makes it much more difficult to ensure that librarians are current with new technologies. The American Library Association and other interested groups should discuss establishing national certification requirements for this reason.

In conclusion, the federal government should consider making grants available as part of its National Information Infrastructure Agenda to assure that professional programs in education and library and information science take full advantage of the Internet. H.R. 1557, passed in August 1993, does provide training monies for libraries and schools but not schools of library and information science and education. Additional funding is urgently needed. The most appropriate grant administrator may be the Department of Education and not Commerce, which is leading the Clinton administration's NREN efforts. The grants would be used not just to revise curricula but also to buy equipment and improve facilities for student and faculty use of the Internet. This funding would also help library and information science faculty and students design and develop better interfaces and tools for the Internet.

NEED FOR IMPROVED TOOLS AND USER INTERFACES

The difficulties of locating, accessing, and using information resources on the Internet are well documented. West (1993) expresses frustration at having so much information available but not quite being able to get at it. Neuman (1992) notes specific difficulties of identifying information, keeping track of information once it is found, sharing information about what is available or maintaining accurate up-to-date information, and needing different mechanisms to access different types of files. Another difficulty, less frequently addressed, is the problem of knowing when one is done searching the Internet. When nothing new is discovered, is it because the searcher has found all that is to be found or that the searcher did not try all options? Organization and standardization have become major issues.

According to Neuman (1992), there are four approaches to addressing the barriers to Internet use: retrieval, indexing, search, and organization. Systems such as the Andrew File System and Gopher provide for the retrieval of files. The Wide Area Information Server (WAIS) and the Semantic File System provide two approaches to indexing. WAIS maintains a full-text collection of documents and allows users free text searching to access the collection. The Semantic File System maintains an index for all files in a collection of file

servers. The Archie database indexes files from selected directories on major File Transfer Protocol (FTP) sites. Entrance search strategies, such as the UNIX *find* command, are used to select the most obvious potential sites. Browsing directories using interactive search techniques is another approach to searching.

Two examples of organizational solutions are HYTELNET and Prospero. HYTELNET (HYpertext browser for TELNET-accessible sites) is a utility that allows an IBM-PC user access (by providing addresses and passwords) to TELNET sites on the Internet. TELNET sites include online public access library catalogs, library bulletin boards, campuswide information systems, FreeNets, full-text databases, electronic books, and network information centers. HYTELNET guides the user through directories of sites on the Internet using hypertext jumps (Scott, 1992).

Prospero is designed to allow the individual user to organize Internet resources of personal interest. An important feature of the system is that the same information can be organized in multiple ways depending upon the needs of the individual or a group, and that users can have access to multiple organizational schemes (Neuman, 1992). Neuman suggests that the usefulness of the individual schemes (directories) will be greatly enhanced when they are referenced from a higher level directory (such as a directory of authors) and that libraries or organizations (such as the ACM and the IEEE) can maintain a higher level of directories based on authors or topics.

Another example of meta-organization are proposals to integrate MARC (MAchine Readable Cataloging) records for electronic material, judged to be of long-term value, into the existing information infrastructure of libraries. Dillon et al. (1992) reported on a research project that "investigated the nature of electronic textual information accessible via the Internet," and tested the "suitability of current cataloging rules and record formats governing the creation of machine-readable cataloging records" for "electronic information objects available through remote network access" (p. 4). Automated categorization for all files at the 1,044 FTP sites available at the time of the study revealed that the amount of formal published information (news, text, data, and image files) is a small portion of the total amount of information available (28 percent). The results of the study indicate that, although some extensions to the MARC format are necessary to accommodate remotely accessed electronic objects, the format is practical and applicable for this type of information (Dillon et al., 1992).

Addressing the issue of meta-organization from another point of view is the work of six issue-oriented task groups of the Cooperative Cataloging Council (CCC). The CCC was established in January

1993 by the joint efforts of the Council on Library Resources, OCLC, the Research Libraries Group, and the Library of Congress to develop and implement a new national cooperative cataloging program. Two proposals related to linking the resources of libraries and library systems are: (1) to create a single Anglo-American bibliographic database comprising records from the various Anglo-American utilities (OCLC, RLIN, UTLAS, WLN), and (2) to create a single Anglo-American authority database comprising name, series, and subject headings created by the various Anglo-American national cataloging agencies (Cooperative Cataloging Council, 1993). These databases, which could include records for electronic information on the Internet, would provide an international resource for information as well as standardization for the international exchange of information.

Locating, accessing, and using information resources on the Internet is difficult and time-consuming. It will require coordinated efforts for educators and students to make effective use of the resources available. Librarians have extensive experience in solving problems related to the identification of potentially useful information and the need for discrimination among large retrieved sets. Teachers and librarians must be articulate on the kinds of retrieval, indexing, searching, and organizational tools that are most effective for assisting the student in the learning process.

Significant progress is being made in the area of the Internet user interface. One example is Mosaic, a software program developed by the National Center for Supercomputing Applications in Champaign, Illinois. Mosaic is a graphical user interface that removes the need to know arcane Internet addresses and procedures. The program is designed to let users browse through the World-Wide Web, a subset of databases available on the Internet. Best of all, the program is free to those willing to download it from the network. Mosaic and other interface efforts are critical to opening the Internet to widespread student use in K-12 and postsecondary environments.

CONCLUSIONS

The Internet can reinvigorate education and libraries, but this outcome is not certain. A key factor in achieving this goal is distinguishing between the technological content of the Internet and embedding it in a particular context. One useful context is information literacy. In addition, a number of important issues must be addressed. These include the changing roles in the classroom, library, and workplace; the economic and geographic barriers to accessing the Internet; the implications of different privatization approaches; the impact of the Internet on professional school curricula; and the need

for better tools and user interfaces. One additional concern should be the integration of Internet resources within the existing infrastructure of the nation's libraries and library systems. In short, educators and librarians must make sure that the evolving National Information Infrastructure reflects their needs and concerns. To do so, they must gain cooperation from the public and private sectors.

The education and library community should use its political clout to gain the support of the Clinton administration's Information Infrastructure Task Force (IITF). According to the *National Information Infrastructure: Agenda for Action* the

> Activities of the IITF include coordinating government efforts in NII applications, linking government applications to the private sector, resolving outstanding disputes, and implementing Administration policies. Chaired by Secretary of Commerce Ron Brown and composed of high-level Federal agency representatives, the IITF's three committees focus on telecommunications policy, information policy, and applications. (National Telecommunications and Information Administration, 1993, p. 7)

In addition, the education and library community should lobby the U.S. Senate for passage of H.R. 1757, the High Performance Computing and High Speed Networking Applications Act, and H.R. 2639, the Telecommunications and Information Infrastructure and Public Broadcasting Facilities Assistance Act. H.R. 1757 provides money to train educators and librarians. H.R. 2639 funds NII planning studies and demonstration projects for nonprofit schools and libraries.

With respect to the private sector, the education and library community should establish long-term partnerships with telephone, cable, and computer companies. It is difficult to imagine a National Information Infrastructure that does not involve all three types of business. Schools and libraries may want to turn to their telephone company and local cable operator for help with planning the implementation of NII technology and a demonstration project. Also, the education and library community should pursue opportunities for cooperation with the major computer companies, which may lead to the donation of hardware and software. The result may be an education revolution in which teachers and librarians help students develop the job readiness skills necessary to succeed in an information intensive economy.

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