Mind Transplants, Or The Role Of Computer-Assisted Instruction In The Future Of The Library

The concept of the library has broadened a great deal over the past several years. Since the time of cuneiform tablets in Sumerian civilization, libraries have been concerned with storing and accessing recorded knowledge. For hundreds—even thousands—of years, this recorded knowledge has been in book, manuscript, and picture form, and only within the past ten years have libraries and librarians become increasingly aware of other media as a source of recorded knowledge. More and more progressive schools have integrated these media into a new and bigger creature called the "learning resource center" which has combined the more traditional library functions and services with vehicles less traditional than the printed word.

What does the learning resource center encompass and why should librarians be concerned with this recently evolved institution? The Carnegie Commission on Higher Education has offered this answer to the question:

Efforts to free libraries from the restraints of a totally print-oriented mission have been underway for many years. The advent of electronic media and new interest in instructional technology have reinforced this interest. One of the main reasons for changes in attitudes on this subject on the nation's campuses has been a realization that the resources of campus libraries (now frequently called information centers or learning-
resource centers) have been inadequately utilized in the instructional efforts of colleges and universities. A manifestation of the new attitude is the physical location of the library at the core of the main instructional facility on several new, small campuses.

A long-standing objection of tradition-bound librarians to the new roles for information centers was breached in 1969 when a joint Committee of the American Association of School Librarians and the Department of Audio Visual Instruction of the National Education Association (now the Association for Educational Communications and Technology) issued a report strongly recommending unification of print and nonprint media in "media centers." As one writer said of the report, "... the Standards recommends a unified media program in which a single institution within the school provides all necessary materials for learning; and quantitatively it prescribes ways for achieving this objective. The words 'library,' 'librarian,' 'audiovisual center' and 'audiovisual specialist' are entirely supplanted by terms such as 'media center' and 'media specialist.' The media center will house all learning materials and accompanying services, putting audiovisual and printed resources under an allegedly more favorable single administrative organization and providing easier access for individual or group study.¹

The handling of instructional media creates a totally new set of problems for the librarian who must become familiar with a new group of materials which often require modifications of existing routines and policies. These affect all areas, including cataloging, classification, storage, retrieval and circulation. In addition, these modalities require specialized equipment, which evokes a myriad of nightmares associated with the procurement, care and feeding of this equipment.

Assuming that this does not paint a rosy picture, the handling of media must be approached from a positive perspective. Other areas in librarianship present equally challenging facets—who among us has not struggled with the Anglo-American cataloging rules? Media and instructional technology are here to stay, according to the Carnegie Commission and educators of all types. In the medical field, for instance, the Association of American Medical Colleges reports that of 135 medical schools in the United States and Canada, 101 have an established unit responsible for instructional materials development and/or management of media.

The implications of this new technology are: (1) the library will become a more dominant feature of the campus, (2) students will need more familiarity with computers as they enter college, and (3) faculty will need to be trained in the use of new technologies.

Up to this point, I have not considered any specific type of media; now I shall reveal my purposes for this lengthy preamble. The learning resource center of the present is primarily concerned with films, videotapes, cassettes, filmstrips, sound recordings, and many other audiovisual modalities. However,
there is an important format on the horizon which many libraries have not yet explored: computer-assisted instruction (CAI).

CAI may well represent the next phase in the involvement of the library or learning resource center in the educational process. I will begin to explain this statement by describing the Lister Hill Center and our experience with CAI.

The Lister Hill National Center for Biomedical Communications had its start in 1965, when the Committee on Appropriations of the House of Representatives encouraged the National Library of Medicine to develop a research capability. On August 3, 1968, President Johnson signed Public Law 90-456, which authorized the creation of the center. Soon after the center's establishment, Martin Cummings, Director of the National Library of Medicine (NLM), asked the Association of American Medical Colleges (AAMC) to take a leadership position in involving the academic medical community in planning a biomedical communications network. A conference was held in February 1969 to consider the educational services that a network might provide. Subsequently, a request for more specific plans resulted in the production of a report from the steering committee of the Council of Academic Societies, Association of American Medical Colleges. The steering committee report included many recommendations, one of which states: "The Steering Committee advocates the organization of a biomedical communications network designed to meet some of the needs of medical education and medical practice and to capitalize on the current state of development of various phases of communications and computer technology. Of primary importance is the requirement to maintain a high level of learning experiences for growing numbers of students to whom medical, dental, nursing and other health career schools are committed."

The AAMC report was presented to the Board of Regents of NLM and the board appointed a Priorities Review Committee to study the report. The committee presented four recommendations which were adopted unanimously by the regents. One of these recommendations has a direct bearing on the establishment of the Experimental CAI Network. It read: "The Committee advocates the organization of a biomedical communications network fundamentally conceived as providing the mechanism by means of which inter-institutional sharing of resources will be used to meet some of the needs of medical education." Implementation of this goal began in September 1971.

In response to this recommendation, the Lister Hill Center Experimental CAI Network was established in July 1972 to test the feasibility of sharing CAI materials through a national computer network. Three suppliers of CAI programs and one commercial time-sharing corporation were under contract to the library to realize the network concept collectively. The three centers of CAI expertise were the Ohio State University (OSU), the Massachusetts
General Hospital (MGH) and the University of Illinois Medical Center (UIMC) in Chicago. In January 1974, a decision to focus University of Illinois support on the PLATO (Programmed Logic for Automatic Teaching Operation) project necessitated UIMC’s withdrawal from the network; since that time we have been operating with the two remaining systems. The Illinois CASE (Computer Aided Simulation of the Clinical Encounter) programs were subsequently transferred to the Ohio State computer.

The network configuration itself allows the OSU and MGH computers to be connected to the TYMSHARE network via minicomputers so that the user need only call one location (i.e., the nearest network node) to be linked to either computer by telephone line. For many users this does not even involve a long distance telephone charge. This network also allows the programs to remain on the host computers so that maintenance and update responsibility reside with the program supplier.

There are programs on the network applicable to health science users in medicine, dentistry, nursing, pharmacology, and allied health professions at all levels—undergraduate, graduate and continuing education. Available programs include microbiology, genetics, biochemistry, physiology and anatomy in basic sciences; cardiopulmonary resuscitation, abdominal pain, diabetic ketoacidosis and coma in clinical simulations; and several natural-language interactive patient encounters in various specialty areas. These programs have been used in a variety of ways by more than 100 health science institutions using 1500-3000 hours of program time per month.

Network Costs

Costs are divided into three main categories: TYMSHARE costs, contractor costs, and NLM staff costs. The TYMSHARE cost is subdivided into fixed costs and costs which vary with increased usage. The fixed costs include the rental of the interface minicomputers at each site, maintenance of the user name file, cost per log-in, and invoice preparation. The variable portion of the TYMSHARE cost is broken down into connect time and characters transmitted. The contractor costs are divided into two parts: the charge for the computer costs, and the charge for personnel support. Table 1 shows the total CAI cost per terminal hour, assuming 1800 terminal hours usage per month.

Initially, the network was free to users. It was later decided to have network users pay an increasing portion of the cost. In February 1974 the charge was $2.50 per hour and in July 1974 it was raised to $5.00 per connect hour.

Although user charges had initially caused a drop in the number of institutions who had access to the programs, that number has now risen to a
Component | Cost (per terminal hour)\(^b\)
--- | ---
TYMSHARE variable communication cost | $ 5.43
TYMSHARE fixed communication cost | 3.28
(TYCOMS, user names, invoice preparation) | 
Computer port charges | 4.66
Computer host personnel support costs | 4.69
NLM Central Staff | 1.66
**Total** | **$19.72**

\(^a\) Does not include user institution costs for terminals, personnel, materials, or local communications facilities.

\(^b\) Terminal hours are not always the same as student instruction hours. Students may work together in small groups.

Table 1. CAI Costs Per Terminal Hour\(^a\)


peak of more than seventy-five users. The number of hours used also dropped, but has been slowly increasing over the past few months (see Figure 1). The interest that has been generated in the network is evidenced by the evolution of an active user group. Largely due to the fact that the library announced more than one year ago that it would not fund the network after May 31, 1975, users formed the Health Education Network Users Group (HENUG) to investigate means of making the programs available after May 31. This group has negotiated with OSU, MGH and TYMSHARE and produced plans for what it hopes will be a viable continuation. For an $8.00-$10.00 per hour charge, users will be able to access the CAI programs through TYMSHARE for a period of ten additional months. During this time, HENUG plans to explore alternatives to the present configuration in the hope of decreasing hourly rates.

The experimental network and user group are unique to networking and to the field of computer-assisted instruction. The network was the first national attempt to make CAI available across institutional lines, and it brought this form of instructional material to the attention of many persons who otherwise would not have had the opportunity to examine programs and student reactions to the programs on a local level. The user group is unique in that it is the first group to attempt networking on a self-supporting basis. At present we have no real indication of the success or failure of this effort, but it is an important step toward the interinstitutional sharing of resources.
The conclusion reached by many as a result of the experiment is that CAI in the health sciences is in its infancy, but that it is a viable teaching/learning modality. However, in the early stages of the network, we were not acute in our perception of where CAI should be marketed. At the insistence of the contractors, we deliberately aimed at the departmental faculty by establishing a dichotomy between "operational" and "trial" users, and by insisting that the "operational users" submit an "Educational Material Use and Evaluation Plan," promise to strive to integrate our course offerings into their curricula, and even train their faculty to produce additional units of instruction. We did not, perhaps because it would have been too easy, circularize our MEDLINE users. We were polite to those few librarians who did manage to find out that the network existed, but gently indicated that they could not possibly muster the faculty involvement required to do all the good things that we wanted. (One such librarian put the quietus to that argument by returning the next week with his dean in tow, and said, "Would you mind repeating that part where I can't get faculty involvement?")
### Location

<table>
<thead>
<tr>
<th>Location</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Libraries and learning resource centers</td>
<td>48</td>
</tr>
<tr>
<td>Medical school departments</td>
<td>23</td>
</tr>
<tr>
<td>Computer laboratories</td>
<td>18</td>
</tr>
<tr>
<td>Terminal rooms</td>
<td>5</td>
</tr>
<tr>
<td>Student study areas, residents lounges</td>
<td>5</td>
</tr>
<tr>
<td>Conference rooms</td>
<td>4</td>
</tr>
<tr>
<td>Offices of medical education</td>
<td>4</td>
</tr>
<tr>
<td>Physicians' offices</td>
<td>4</td>
</tr>
<tr>
<td>Emergency rooms</td>
<td>3</td>
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<tr>
<td>Ward rooms</td>
<td>2</td>
</tr>
<tr>
<td>Cardiac care units</td>
<td>2</td>
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</tbody>
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Table 2. Location of CAI Terminals on LHC Experiment

<table>
<thead>
<tr>
<th>Institution</th>
<th>Terminal Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of California-Los Angeles</td>
<td>Library</td>
</tr>
<tr>
<td>University of Pennsylvania</td>
<td>Library</td>
</tr>
<tr>
<td>Harvard Medical School</td>
<td>Library</td>
</tr>
<tr>
<td>Medical College of Virginia</td>
<td>Library</td>
</tr>
<tr>
<td>University of Washington</td>
<td>Learning Resource Center</td>
</tr>
<tr>
<td>University of Texas-San Antonio</td>
<td>Library</td>
</tr>
<tr>
<td>Stanford University</td>
<td>Learning Resource Center</td>
</tr>
<tr>
<td>University of Arizona</td>
<td>Library</td>
</tr>
<tr>
<td>George Washington University</td>
<td>Library</td>
</tr>
<tr>
<td>University of Oregon</td>
<td>Computer Center and Educational Resources Facility</td>
</tr>
</tbody>
</table>

Table 3. Location of Terminals with Highest Mean Usage

Despite this shunning of libraries, we found that a large number of the terminals on our network—even some of our major users—were in fact in libraries. Table 2 shows a location breakdown of terminals used for CAI, and Table 3 shows that of the ten largest users, nine were centers managed by libraries or learning resource centers.

Given that instructional technology, and more specifically computer-assisted instruction, is here to stay, how can librarians use it to their advantage? The network concept has demonstrated that schools are willing to share CAI materials; however, the present configuration is too costly for the long run. Therefore, alternative distribution methods must be explored. We are looking at computer language translation to allow wider distribution of
existing and future materials, which would spread developmental costs more evenly. We are also examining the use of minicomputers at the institutional level for providing programs to on-site users.

The minicomputer has advantages for both the library and the development of CAI. It allows the creation and maintenance of CAI programs at an individual institution, alleviating problems of tailoring imported materials to fit a curriculum. In addition, a minicomputer is a far less expensive piece of computer equipment to procure than a monstrous central computer. Its use lowers communications costs which can be prohibitive to the user in Boise, Idaho, whose nearest network node is in Denver.

For the library, a minicomputer can be the answer to problems in library automation. Strides are being made toward its use in library systems, which offers many benefits also found in CAI. At the University of Minnesota Bio-medical Library, Glenn Brudvig and his staff are designing a total library system supported by a minicomputer and funded through a grant from NLM’s Extramural Programs Division. A brief survey of automation projects, however, reveals that few libraries have discovered the virtues of minicomputers. A local minicomputer is less expensive to obtain and operate than a larger configuration. In addition, the larger computer is nearly always shared with other parts of the institution and library functions are frequently of low priority. This means that systems must be designed to run in batch mode (to be updated during nonprime hours), and often the librarian does not have access to the file during regular working hours. The combined needs of a CAI system and automation project in the library could conceivably justify the procurement of a minicomputer for use by the library or learning resource center.

Another alternative to large network CAI also has implications for the library. We are currently exploring the use of “intelligent terminals” for the purpose of supplying CAI. An intelligent terminal is simply a desk-top device with keyboard display and a small memory, which is entirely self-contained. By plugging in the terminal and loading the CAI program by cassette tape, an entire program library can be made easily available. This device lends itself particularly well to use in the library because it requires little technical knowledge, no programming support, and does not depend on the up-down time of a larger computer.

The writing of new programs is also simplified by an authoring language which has been tailored specifically to the intelligent terminal. PILOT, as the language is named, can eliminate the authoring stumbling block by encouraging faculty to attempt creation of their own programs. Prior to this development, most authoring has been done in conjunction with programmers because of the technical level of the authoring language. This has discouraged many faculty members who have neither the time nor inclination to spend with a more cumbersome process.
A few years ago, a colleague of mine was approached by a salesman for a commercial abstract service. He raised an eyebrow at the price—over $1000 per year—and asked what luck the salesman had in selling his service to libraries. He answered, "I don't sell it to libraries—it's too expensive for them. I sell it to directors of research, who keep it in their offices."

Computer-assisted instruction has had similar problems over the years. Academic departments, computer science laboratories, and specialists in instructional technology have combined forces to develop these programs. The pathways from computer to user have all too often bypassed the library. Librarians may well have been aware of these programs, but never thought of them as coming within their scope.

We think that libraries will find computer-assisted instruction a useful service to offer their clientele. However, it is wise to keep in mind the fact that CAI is different from other library and audiovisual materials. CAI is a living, dynamic tool which actively involves the user, we think that this makes it an even more desirable addition to the library. David Kronick, librarian at the University of Texas Health Center, San Antonio, said, "Anyone who sits at a terminal interacting with a computer based teaching program must feel the presence of another fine and active intelligence who is using the computer as an effective intermediary and thus providing greater access to his teaching skills."5

The fact that CAI lives is evidenced by comments received from students themselves: "It was very useful to help develop clinical judgments"; "This program was realistic, stimulating, and a good review of a topic which many internists lose familiarity with soon after leaving their residency and fellowship years"; and "Although I realize that the computer is expensive, I feel that its use by students is extremely beneficial."

Although computer-assisted instruction is still in the experimental stages, its potential as a learning resource is becoming more and more apparent. However, I hope that every learning resource center of the future—no matter how many minicomputers, intelligent terminals, videotape projectors and bio-feedback sensory learning carrels—will still maintain a stock of books.

REFERENCES


Additional References

