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## Automated Systems for Information Retrieval in Education

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## AUTOMATED SYSTEMS FOR INFORMATION RETRIEVAL IN EDUCATION

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### ABSTRACT

Efficient retrieval from all kinds of knowledge sources via automated electronic systems is the key to future requirements for transmission of educational information. First-generation hardware is economically and logistically feasible today for any size institution or organization. An example, the Electronic Inquiry System utilized successfully by learners and faculty at Brevard Junior College, is described. Main advantage is the individualization of study procedures. Such configurations may be the prototype for tomorrow's systems of total access and interaction.

### NEW INFORMATION REQUIREMENTS

Access to and retrieval of all types of software through the utilization of automated electronic systems is the key to predictable upcoming requirements for the transmission of educational information.

The user of an on-line knowledge retrieval system in the near future, whether he be student or engineer, business executive or medical doctor--anyone who seeks up to date information or background knowledge--needs to be able to easily and efficiently ask for specifically required information, then receive it with touch-button speed and reliability of access regardless of software and hardware sources.

Such systems must be designed to meet the exact needs of their users. An individual system must provide the capability of being queried and of virtually immediate reply. It must utilize a variety of forms of storage and of means of presentation.

In our democratic society, nothing short of total access to complete knowledge sources of all kinds can be accepted. Virtually

instantaneous retrieval of every piece of information available to mankind must be provided for tomorrow's citizens, in school and college, at the office, lab, and home. This applies to the reception of information by all of the learner's senses eventually, but the first series of retrieval system configurations no doubt will concentrate on output for the eyes and ears only. Display will probably consist of combinations of video and associated kinds of screens with accompanying audio and capabilities for in-hand copy, in both film and hard-copy formats. Information resources tapped by these systems will encompass live presentations as well as recorded knowledge; storage will consist of all the usual forms of mag tape and disc, audiotape and videotape, and EVR and film materials including all types of microforms.

Users of these automated systems must be able to inquire of all probable sources of information and quickly narrow the search down regardless of how non-specific their first query may be. In all likelihood this search will bear close resemblance to person-to-person dialogue. A user should be able to receive abstracts or total recall, to annotate or extract, to rerecord video and audio, and to receive data and documents in several choices of display and printout. He should be able to store his own notes on a confidential basis. User input may be by such combination methods as voice, pen, and touch-button.

Various hardware configurations providing simple first steps toward the above requirements are already functional. With careful design, these first-generation systems are economically and logistically feasible for any size institution or

organization today.

### THE ELECTRONIC INQUIRY SYSTEM

An example of a step in the direction of a total systems concept for educational information is the Electronic Inquiry System which is in operation at Brevard Junior College (Cocoa, Florida). This system is a simple one contrasted with what the future portends, but it is also relatively sophisticated compared to operational equipment at the bulk of educational institutions today. The hardware consists primarily of automatic on-call video and audio distribution to a series of "inquiry modules" or electronically supplied study booths. The EIS also provides wired stereo FM transmission to every classroom on the campus.

The learner who enters an inquiry module study space may access 11 video channels, for both live and recorded materials, and 60 audio sources. The module's video screen may be used for computer display as well as television output. Audio access is to both stereo and monaural tape sources which utilize reel-to-reel and cartridge units remotely controlled. Each module also has a shelf designed for CAI, teletype, or facsimile terminal or typewriter. (Figures 1 and 2)

EIS access to program sources is by dialing a two-digit number for audio resource and three-digit for video or computer output. Sound is heard via earphones, and CRT picture retrieval is instantaneous regardless of how many users are seeking access at any moment. A boom-type microphone on the learner's headset is used for oral responses direct to machine materials or for making requests of the control center operator. Reel units automatically start on remote control, and automatically rewind to the beginning whenever a study location completes use of it. While any user station remains tuned in, the tape continues to recycle as long as that learner so desires.

Cartridge sources are controlled remotely for all functions, including fast forward and rewind; they are used for rerecording of audio information as well as for voice record by the learner as in language skills practice or in the recording of test responses. Also in use are mechani-

cally operated disc and tape recorded sources for both requested and scheduled programming--these are utilized primarily for transmission to classrooms. Switching gear provides nine additional video channels which may be activated when additional program sources become available.

The EIS is the prototype of a concept for joining together what many educational institutions operate in hit-and-miss fashion as they utilize the uncoordinated distribution of closed circuit and open circuit video, of computer access and multi-media, of teaching machine labs and automated response and distribution capabilities. The system centralizes hardware operations for electronic communications into a core (or central location) which can be controlled by the user at his own remote position. This core is the key to reduced maintenance, to the cutting of costs, and to the abolition of both hardware and software distribution failures. At the same time, it provides a broad base of instructional materials' availability with rapid access and a great saving of time.

The inquiry modules are designed primarily for quiet study by one individual although capabilities allow two persons to utilize the equipment to study together if they wish. Additional features are a cassette machine in each booth for local control of cassettes, and a jack for rerecording of audio material directly onto the student's own machine if he wishes to plug in.

This knowledge inquiry system, designed at Brevard, may be easily and quickly expanded by modular additions to the switching gear, to the program sources, and to inquiry locations. Each shelf in a module may be lifted directly out of the space to provide either single-shelf or multiple-shelf display. A built-in fluorescent light is provided, and convenient electrical outlets make it simple to utilize dedicated 8 mm rear screen projectors, microfilm readers, filmstrip projectors, and reading pacers.

EIS video software consists of live, videotaped, or filmed instructional TV programming. This includes demonstrations, lectures, student and faculty panels, talks by guests, theatrical dramas, and demonstrations of teaching techniques. Most of the audio program materials have resulted from preparation of talks or tests,

classroom discussions, and selections of stereo music.

#### SYSTEM ADVANTAGES

System advantages to the user are automated retrieval without requiring him to manipulate his own tapes, discs, or machines, and availability of materials in a pleasant, quiet atmosphere where each learner may study at his own selected time and at his own pace. The student does not have to wait his turn or go to several different spots to pull together related information--everything can be accessed from his own study location. Study becomes individualized with such a system. The learner may review and repeat at leisure, and the information can be considerably more up to date than that in textbooks if the instructor so desires.

Student comments indicate the system's availabilities are very well thought of. Approximately one quarter of the students access more than one source each time they enter a module. They often select non-assigned materials for browsing.

Program materials have been utilized in virtually every instructional discipline. Subject matter areas have included political science, humanities, psychology, nursing, French, Spanish, marketing, physics, study abroad, history, German, and Russian. Other subjects are speech, music, communication, literature, journalism, remedial English, secretarial science, biology, chemistry, drama, and broadcasting. Instructors who have produced their own program materials for the EIS spend more time in preparation than for a usual classroom or lab presentation. Many have reviewed both those materials which are commercially available and those turned out by their colleagues, and they have taken great care in making selections.

The advantage of the EIS to the instructional staff is that they now may utilize systematized educational technology as a regular part of their teaching. In doing so, they are learning how retrieval systems can be utilized logistically and especially how to mold instructional materials to the definitive learning objectives they have proscribed for their students. They can make daily changes or additions and annotations to the EIS if

they wish. They can make outright assignments or suggested supplementary assignments. Teachers may also utilize that part of the EIS which provides high fidelity FM distribution for classroom and auditorium retrieval of stereo and monaural materials. This may be done by advance scheduling or by picking up the phone headset on a classroom tuner and making an on-the-spot request.

Instructors who produce software for the system have found they cannot simply rely on their conventional lectures. They must structure objectives which are behaviorally oriented for their courses, and then the media needs become almost self evident. They may utilize different levels and types of software according to the particular learning objectives to be reached or learning problems to be solved.

The future for faculty members who grasp the characteristics of various types of automated software is that they can put the burden of imparting routine information, of handling many questions and answers, and of supervising repeated practice onto the machines. The instructors themselves can then place increasing emphasis on counseling, individual tutoring, and solving of the learning problems of students rather than repeating traditional lectures ad infinitum, constantly worrying about paperwork and sorting students into graded groups.

In the future, the staffs of educational institutions which produce media must be prepared to fully support automated retrieval systems by production of a variety of types of learning materials. These may run from computer-assisted and computer-managed instructional programs with or without visual accompaniment to single concept and complete-course units on color videotape, EVR, and 8 mm. film--it will also include an array of audiotapes on cassettes, cartridges, and reels, as well as microfiche, microcards, and other film formats, aperture cards, and overhead transparencies.

An automated retrieval system which has been set up for instructional use can then be expanded to include complete management information and the handling of all records. Terminals or study locations can be provided throughout all buildings. Such a system may also be tied in with



other institutions as the first step of networking operations.

#### CONCLUSION

Today's knowledge retrieval methods for learner use are but a beginning step compared with the potential possibilities for automated information systems and their value for individualized communication and educational purposes. Very little time will elapse before every educational institution and every industrial training group will need to place into service even more extended retrieval capabilities than those described here, and the study locations for these will be throughout the organization, including the dormitory rooms on college campuses. Equipment utilized by students and staff may very well become the prototype of the learning stations that will eventually be available in everyone's home.

On the horizon are various size networks of knowledge banks--banks of stored materials, of programs in process, and of interacting information. These materials will be dissimilar, but will combine such sources as printed and microfilmed books and serials, computerized data in many forms, and motion picture and TV tapes all available in instant access. Learner interaction will also be possible with on-going conferences and committee meetings, and with live authorities whom the user may want to confer with individually or in groups. Procedures will allow problem-solving situations, testing, tutorial advice, debating, gaming, and simulation of all kinds. Information about what aggregate knowledge is where will be readily available.

Systems' interfaces with learners, which in a democracy really means all citizens, must always be designed from the learner's viewpoint. The social implications of informational systems and knowledge networks tapped by every individual, each with his own specialized needs, will quite obviously be enormous.

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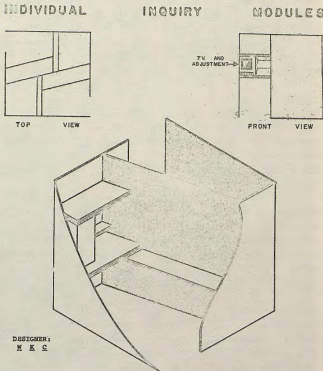


Figure 1. Back-to-Back Inquiry Modules.



Figure 2. Student using EIS for Study.