ON-LINE SYSTEM FOR UNIVERSITY-LEVEL TRAINING OF TECHNICAL SPECIALISTS

A. N. Andreev, A. V. Blinov, N. K. Yurkov, and A. N. Yakimov

A method is proposed for using a telecommunications network for the on-line instruction of students in universities. Various aspects of creating electronic textbooks with the use of multimedia technologies and situational modeling are examined. The article discusses the feasibility of using problem-solving techniques in the texts as a cognitive aid.

The concept of on-line information centers in university departments and the prerequisites for creating such centers are being influenced by the trend toward the integration of Russian scientists and engineers into the world intellectual community. With the use of local databases that are oriented toward a specific area of science or engineering and are organized on the basis of computer centers, it is possible to break the existing monopoly on outside scientific, technical, and other corporate information by providing access to different databases from Russian and foreign sources.

A departmental on-line information center (DOLIC) is created as a component part of the information infrastructure that presently supports and coordinates teaching and scientific research. Such a center makes it possible to provide information and documentation for the entire cycle of instruction, scientific research, and experimental design, as well as producer-customer relations. The information-communications service offered by centers of this type can be compared to a supermarket of international information, distinguished from traditional services by the fact that it can be accessed without leaving the workstation.

The departmental centers should also be a component part of the university information system (UIS). The most important factors in the information infrastructure of the DOLIC are the actual information needs of the users and the availability of extensive information resources. These resources are in the form of information flows of varying levels and can be accessed through the existing communications network of the UIS.

Departmental on-line centers are unique information windows for personal use, allowing individuals to access global databases. This means that a small group of people with a common interest, working in a specific and limited area of scientific or pedagogical research, can connect with a worldwide information network and improve their knowledge of the given subject without straying from their particular field of expertise. In this case, the information that is of interest is quickly sent directly to the user: scientist, instructor, postgraduate, engineer, laboratory technician, undergraduate. Realization of the above-described concept will make it possible to connect each university department to the Internet.

Information flows can be conditionally separated into five levels with respect to the volume of information circulating in them and their geographic dissemination: the international network Glob TPN, the Russian network Ru TPN, the regional network Penza TPN, the local (university) network Univ TPN, and the local (subdivision, department) network.

All of these levels are connected to one another, which makes it possible to obtain the widest possible variety of information on any of them, i.e., two-way circulation of information from the local to the international level and back is possible in the system. However, it is necessary to ensure that the center is equipped with certified and licensed hardware, to avoid incompatibility with the network equipment and protocol.

The architecture of the DOLIC network is a three-level information system that includes the solutions of problems for the levels organized for students, professors/instructors, and administrators (Fig. 1). Having such a structure for the network maximizes the accessibility of the information resources and services provided by the Ru TPN to users at the department level. In determining the principles on which to design the departmental network, one criterion that might be chosen is minimization...
of the costs connected with the creation and subsequent operation of the system. When the modular principle is employed, the network is connected first at the university level and then the department level. This is the principle on which the network at Penza State University was successfully built.

The main condition that must be satisfied in constructing a network is ensuring compatibility of all of the components, from Glob TPN to the department level. Having such compatibility allows each component to have access to any level, including the international level. Figure 2 shows the elements of a possible DOLIC design.

In order for the center to be able to fully communicate with both the international and the Russian networks, it is best to integrate the local networks into the existing data transmission networks (international and Russian) as much as possible. Such integration can be achieved by providing direct access through dedicated lines in the networks Relcom (as part of the Internet), Rospak, Rosnet, etc. The automated information system of the DOLIC has the following main components: servers, workstations, Russian telecommunications centers.

The file server manages the operation of the entire computer system. It includes special individual databases that are of value to specialists at the center, system software, and special programs. The database (DB) server is designed to create and operate databases. An example is the SQL server, which supports distributed databases. The CD-ROM server is designed to provide local or remote access to databases located on compact disks. The edifact server links the workstations of the operators with distant users. A list must be prepared showing the standard inputs that must be used with the information channels (hosts) to obtain access to information resources. However, in view of the economics of the system, for the needs of a university department this list can begin with the INTERNET host (www-server).

Thus, the proposed structure of the departmental on-line center makes it significantly easier for specialists to obtain information on scientific and educational-methodological research, communicate with other specialists, and ultimately make them more interested parties in the results of that research. The instructional process can thus be elevated to a new level. In connection with this, it will be necessary to develop electronic databases (textbooks, lab manuals, plans, handbooks, etc.) for instruction directly within the department and on-line.

Computer technology has been widely introduced in recent years at the university level to educate and train specialists. By using a large information base and multimedia technology, modern computer-based teaching systems make it possible to present course material in the most complete and clearest form. Such systems combine computer graphics (including animation) and "live" video, sound (music, for example), and text, and include references to different chapters of the text that are based on associative or contextual links to certain terms (hypertext).