RESEARCH FORUM

The scholar's workstation

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The idea of a scholar's workstation has emerged from the development of new and powerful microcomputers capable of handling a number of the tasks involved in the research process. Obviously research in nuclear engineering varies greatly from that in Elizabethan drama, but nevertheless many of the activities involved are the same. The main medium of communication in all fields is still the research paper or monograph.

A scholar's workstation must have all the tools necessary to develop ideas, carry out the information processing aspects of the research and produce the paper. The metaphor of a workstation or workbench is really rather apt, since a set of specially designed tools are arrayed on the researcher's desk. These tools must function smoothly together, and the system must allow for extensive communication with colleagues that is such an essential part of the research enterprise.

From creation to publication

The aspect of research common to all disciplines is the creation of the written work. Currently, the creation of the paper or monograph is usually done by a number of individuals ranging from the author(s), the editor, the typesetter and the printer. With the development of new hardware and software the entire process can now be under the control of the author. The processing of words into finished typeset manuscripts benefits greatly from automation. Critics have argued that the advent of the word processor has turned creative scholars into typists. Since automation can accomplish much of the routine work, the transfer of control to the author does not carry with it all the drudgery usually associated with the production of printed works.

The recent progress in typesetting software has been dramatic. In the past, typesetting software and hardware systems were specialized for the publishing industry and prohibitively expensive for individual researchers. Now, however, these systems are migrating to microcomputers and are becoming generally available. A software package called TeX has been developed for MS-DOS Personal Computers and it allows for comprehensive typesetting and page composition. Output can be routed to a simple dot matrix printer for draft work and to a high quality laser printer for finished work. The system also interfaces with professional typesetting machines for publication quality results.

The research process

At the risk of oversimplifying the process of research, the process and the resulting manuscript generally follow the outline of: 1) statement of the problem; 2) the literature survey; 3) analysis of data; 4) statement of results; and 5) conclusion. Such a structure, with variations, can be used in almost all fields. The tools needed for each part are different and will be tailored to meet the needs of specific disciplines. For example, the word processor used for comparative literature must be able to handle non-English character sets, while that used in physics must have the symbols of mathematics. Certain tools are common to all disciplines, for example, bibliographic organizers and typesetting systems.

The tools available for each part of the generalized research process fall into relatively distinct categories. The definition of the research problem, and the subsequent outlining of the project and the resulting paper benefit from the use of what are called "idea organizers." Such software allows the researcher to work extensively with outlines and modify the outline with ease. They are often considered "brainstorming" tools because they allow the entry of ideas in random fashion and then permit easy organization of the ideas.

The literature survey can be aided by a variety of tools ranging from specialized communication software for accessing online bibliographic databases, to software for formatting bibliographies according to the requirements of journals or publishers.

The aspect of the research process that varies most across disciplines is the collection and analysis of data. This can range from the collection of primary documents most common to the humanities to the gathering of numerical data for analysis. Not surprisingly, the software for this activity also varies greatly according to the discipline. In general, the software consists of statistical analysis or modelling programs because those programs have historically been available for computers. The musicologist's analysis of original manuscripts, for example, has not been so well represented in the catalogs of available software. Specialized software is emerging in virtually all disciplines, so that the analysis procedures common to a field are included. Economics, sociology, engineering and science are especially rich in such specialized software.

The delineation of results and conclusions are usually handled by generalized word processing software, but even here, specialized systems are being developed. Word processors designed for business use will provide most of the required functions. More specialized software will provide extensive footnoting, allow processing of larger manuscripts, and will provide the necessary special characters.

Literature management and the scholar's workstation

Any work of research or scholarship must refer to previously written work. Indeed, the bibliography by itself is often a work of considerable scholarship. The management of citations usually proceeds in the following way. At the inception of the project, often for the proposal, a collection of materials is gathered. This collection is constantly added to as the project progresses. Often annotations are made on the individual records, and the documents themselves are acquired and collected. The annotations eventually form part of the resulting publications, and the citations end up as footnotes and bibliographies.

Sources of bibliographic information are proliferating and library catalogs are being automated at a rapid rate. This means the campus-based scholar can search the online catalog and determine the status of a book or journal from his or her office or home. Once the libraries set up document delivery systems, the researcher can order the book delivered as well. As all systems go to CD-ROM systems, I can envision a freshman arriving on campus and buying a compact laser disk containing the univer-

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Definition of research can be done with an "idea organizer."

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sity's entire library catalog. This database can be searched and the documents ordered just like pizza delivery. No doubt the catalog compact disk will be shelved next to the student's audio disks.

Before computers, the management of bibliographic data required a great deal of redundancy of effort. When a search was done in the library catalog, the data was copied onto 3x5 cards, annotations were added, and the result retyped into a bibliography. Surely, as soon as the bibliography was typed, two more relevant citations had to be added! The documents themselves had to be obtained and if they had to be acquired through interlibrary loan, the delay was often weeks or months.

Our work developing the *Professional Bibliographic System* with *Biblio-Link* is an attempt to create the literature management part of the scholar's workstation. The software allows the researcher to access online database systems or online library catalogs by telephone and convert the downloaded records to citations in the microcomputer. The *Professional Bibliographic System* provides comprehensive management of the records and allows them to be retrieved and printed in all the ways that a scholar would use them. Output formats can be custom tailored to any journal's style requirements. The citations or the annotations can be merged into the manuscript. A subset of bibliographic records can even be sent by telephone to a document delivery service and the documents will be sent by mail or facsimile transmission. As the databases migrate to the CD-ROM devices, the entire system will be a self-contained workstation. Of course, communication with colleagues and exchange of bibliographic and other information will require telecommunications.

The idea of a specialized bibliographic database is central to perhaps a majority of research projects. Such a database is a growing and dynamic collection of the works relevant to the researcher or the research team. To use the collection effectively, the scholar must be able to find items easily, quote

from them, and transfer the data to a manuscript. The system requires flexible importing and exporting facilities. Data must be imported from many sources, including the online resources, local library systems, as well as other scholars' systems. The system must allow exportation to a manuscript or to a typesetting system. It must also allow export to another individual's computer. A logical extension of the system is the publication of bibliographies as computer files, such that the recipient of the bibliography could merge it into an existing database or add to it as much as necessary. Updates could be sent out as diskettes or they could be made available online.

CD-ROM technology now allows the CD player to work side by side with a diskette drive or a fixed disk drive. Access software will be identical. Imagine accessing a CD-ROM system with over one million citations in your field and at the same time accessing a diskette with the latest update on it. Modification of the file will be to the diskette, but it will all look like one file to the user. The obvious next challenge wil be to develop retrieval and data management systems worthy of the new hardware.

Document production in the Age of Electronics

After the idea of a research project is born, the first step is the preparation of a proposal, either for obtaining funding for the project or to organize the research activity. Once the idea is refined into a clear statement of the problem, the literature search is begun. This searching of the literature and adding to the bibliographic database continues throughout the course of the project. As new information comes to the attention of the researcher, it is added to the database. While the body of information is small, it is easily managed, but as it grows an effective retrieval system is necessary.

During the early phases of the project the researchers can take notes on the works and add them to the citations in the database. Later, when the papers and monographs are written, the notes will form much of the text. With the *Professional Bibliographic System* the quotations from the text of the notes can easily be transferred into the manuscript. The citations themselves can be transferred as footnotes or endnotes.

The gathering of information for a research project is complicated by the diversity of the sources. In many fields, literature from a number of disciplines might be relevant, so that searches must be conducted in several online databases and in several libraries. Studies of overlap among databases show that it is less than might be expected. For example, the researcher looking for information on "automobile lubricants" might search databases of the American Petroleum Institute, the Society of Automotive Engineers, the American Chemical Society, Compendex (Engineering Index), and several others. A number of different libraries might be used as well.

The database created for the project is useful in itself. It could become a part of a larger database that serves several groups of researchers in related areas. The database would identify certain citations as of interest to specific individuals or groups. It would function much as the Research Libraries Information Network, but instead of tagging the records with the University holding them, the records would be tagged to identify the individuals most interested in them. This database will reside on a file server connected to many micros. For this reason, the MS-DOS and Macintosh editions of the *Professional Bibliographic System* will use the same internal record formats. This way many different computers can be served by the database.

As the research progresses, analysis of the data is aided by the computer in ways specific to the discipline. In many cases the output of the analysis, whether textual or graphic, can be incorporated into the manuscript. The description of results could be input directly into the word processor.

Final editing and entry of typesetting codes prepares the document for final printing. In many cases the final manuscript submitted for publication is already in "camera ready" form.

The scholar's workstation concept takes the research paper from an idea to final publication. It makes the process easy and efficient, greatly reducing the delays between writing and publication. In areas where the cost of producing the finished publication inhibits the transfer of knowledge, the systems provide the means for self-publication or publishing on demand. A side result is the entire publication in machine-readable form, ready for entry into electronic publishing systems. The availability of manuscripts in this form aids communication among scholars, and feeds directly into new documents written by others. As more and more scholars gain access to the scholar's workstation, a new cycle of communication and scholarly production begins.

Research opportunity

The ALA Library Research Round Table is accepting entries for its 1986 Research Competition, which features a $500 award. All papers submitted must represent completed research not previously published or currently under consideration for publication. To enter the competition applicants should send three copies of the paper no later than February 1, 1986, to the chair of LRRT's Research Development Committee: Mildred Lowe, Director, Division of Library and Information Science, St. Johns University, Jamaica, NY 11439.

Papers will be judged on the following points: 1) definition of the problem; 2) application of research methods; 3) clarity of the reporting of the research; and 4) significance of the conclusions, as judged by the Committee. The winning paper will be announced at ALA Annual Conference in New York and will be published promptly in an issue of *Library and Information Science Research*.

Guidelines for the competition may be obtained from Mildred Lowe at (718) 990-6162, x6200, or from the address given above. ■■
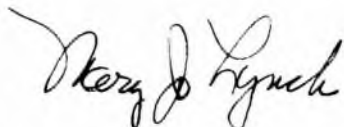
Author query

For a book on innovative organization structures in libraries, I would appreciate hearing from libraries or implemented non-traditional structures of any kind. Organization charts, job descriptions, explanatory notes will be gratefully accepted. Write Joanne Euster, Library Director, San Francisco State University, 1630 Holloway Avenue, San Francisco, CA 94132.