COMPUTERS IN TECHNICAL COMMUNICATION:
APPLICATIONS AND EDUCATIONAL IMPLICATIONS

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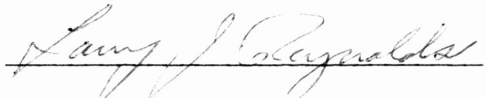

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ABSTRACT

This report discusses the applications of computers to technical communication, especially writing, and how those applications influence the educational needs of technical writers. A literature review illustrates the various applications of computers to the publication process. A survey of 50 technical writers in Texas supplements the literature review by providing a current picture of computer use in technical communication. To clarify some considerations raised in the applications discussion, a brief literature review and a survey of 20 technical writing educators sum the educational responses to computer use in communications.

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INTRODUCTION

Background

Until recently, technology advanced at a rate far greater than the documentation supporting it. One unfortunate result of the time interval previously required to process information has been the distribution of obsolete technical information in journals and other documents. The significance of that situation becomes evident when viewed in the context of the information explosion (1).[1] Yet, technology itself during the last 15 years has increasingly entered communications to help alleviate those time lapses and other related problems. The technology applied to communications (technical and otherwise) primarily involves computer hardware and software, and computer-related equipment. Thus, as businesses and industries introduce computer systems into their technical communication departments, the communicators must adjust their traditional roles. Further, as technical communicators' roles change, educators in technical communications must stay attuned to the educational requirements of the profession.

[1]The documentation in this report follows the style used in the Journal of Technical Writing and Communication.

Purpose / Scope

This report addresses technical writing educators as a guide to computer use in technical communication and to possible educational responses to that use. A literature review and the results and analyses of two surveys are included in the sections which cover computer applications and educational implications.

COMPUTER APPLICATIONS

Literature Review: Traditional Vs. Automated Publication

The literature on computer applications in technical communication covers a broad range of current technological capabilities. Some of those capabilities go beyond the scope of this report, which focuses on the technical writer/editor. Please refer to the Bibliography for more information on various communication-related technology.

A comparison between the traditional, or manual, and the automated publication processes reveals some of the computer applications in technical communication. Appendix A (p.19) illustrates the relation between the steps in the two processes. Note that automation eliminates over half of the steps in traditional publishing. Both processes include three main phases: text entry and editing, text formatting and processing, and text distribution.

Text entry and editing. The automated version of text entry and editing provides the communicator with powerful tools. According to Berman and Wasser, computerized text editing started when large systems users realized the machines could store, edit, revise, and print routine administrative reports (2, p. 3).

In the traditional publication process, text entry and editing include the first 5 steps shown in Appendix A; in the automated process, the first 3. As in the traditional method, automated publication begins with keyboarding the material. The two methods differ in that the writer enters the material on a video display terminal (VDT)[2] in the automated process rather than on paper, thus enabling electronic, instead of manual, manipulation of the text. In traditional publishing, the entire text usually must be retyped after editing to maintain a correct format. Since no hard copy must be produced in automated publishing until after all corrections are entered on the VDT, automated text entry and editing eliminates unnecessary retyping, further error introduction, and complete reproofing. Banyai, Selle, and Spencer cite the disadvantages of rekeyboarding: keyboarding is expensive and time consuming, and rekeyboarding requires an additional step, reproofing (3, p. 241; 4, p. 27; 5, p. 10). Correction and manipulation of material on a VDT is immediate--letters, words, sentences, or paragraphs may be inserted, deleted, or rearranged with equal facility. Banyai notes the unimportance of the initial text sequence on a VDT, since any portion of the text can be retrieved and properly sequenced at any time (3, pp. 237-239). With such flexibility, last minute changes pose no problem.

Automated editing yields even further flexibility through a capability known as "global" editing. Rosenbaum explains that systems equipped with global editing use a single instruction to direct the system to change a word, phrase, or number from the original to a newly

[2]See Appendix B (p.20) for a brief discussion of the VDT and how it relates to a computer system.

designated one in every instance it occurs in the text (6, p. 230). In traditional publishing, a last minute product name change probably would result in missed deadlines and extra expense. In automated publishing, a last minute change requires only a little typing.

Automated proofreading for spelling errors has helped reduce another mundane, time consuming task of traditional publishing. Moghdam describes a proofreading system called AUTOMARK developed by the American Newspaper Publishers Association Research Institute. AUTOMARK identifies misspelled and unusual words according to the following program:

> 1. Small words are matched against a common word reference.
>
> 2. Remaining words are verified according to the number of times they occur in the text with the same spelling.
>
> 3. Words not verified by the first 2 steps are checked against a master dictionary stored in the computer memory.
>
> 4. If the above fails to verify a word as accurate, the word is underlined automatically in the output. All numerals, too, appear underlined (7, p. 110).

Berman and Wasser mention a program which verifies the author's spelling and use of acronyms (2, p. 3). Although helpful, these proofreading systems do have limitations, such as the inability to locate errors which result in valid words (8, p. 84).

Text formatting and processing. In traditional publishing, text formatting and processing involves steps 6-14 shown in Appendix A; in the automated process, step 4. Even if a technical writer or editor has little or no involvement with text formatting and processing, automation

in this phase of the process affects him. The less time required for preparing the material for printing, the more time available for writing and editing.

Often a writer must provide a table of contents, list of illustrations, and index. In manual publication, creation of those elements proves laborious and error-prone. A computer properly programmed, however, can extract the necessary information from the text to generate those elements. Banyai indicates that a table of contents can be created based on section numbers or heading orders (3, p. 239).

Other formatting capabilities of automated publication include automatic paragraph numbering, automatic pagination, and space allocation for graphics (6, p. 228). Graphics, often vital to a technical report, may also be generated through an interactive design process between an artist and a computer. Field explains than an artist enters design calculations onto the VDT and the design form appears on the CRT screen. Using the keyboard and a light pen attached to the VDT, the artist can rotate the design to different angles and adjust the design to fit his specifications (9, p. 216). Manipulation of graphics on the screen occurs rapidly--thus aiding the writer in that he has greater range in selecting the graphics for his publication.

Before the introduction of automated processing techniques, publication printing was extremely slow and repetitive. Note in Appendix A that the steps involving the galley proof, page proof, and blueline are designed to assure proper typesetting and format. Once the material is correctly entered on the VDT, however, typesetting and formatting codes

assure correct layout. The writer's range of specifications include type faces, type size, and paragraph styles (6, p. 229). Again, the reliability and speed of photocomposition allows for last-minute printing, thus giving the writer greater control over the final publication.

Text distribution. As in text formatting and processing, the time required for the last step of the publication process, text distribution, affects the writer's schedule. Several automated alternatives to traditional distribution methods (like mailing) make it possible for a writer to send and receive information faster, cheaper, and without the risk of losing important documents in transit. Those alternatives include such computer-related processes as transmission of page images by telephone or microwave lines, or by a communications satellite (7, pp. 143-145).

Survey of Technical Writers

Much of the literature on computer applications in technical writing indicates that technical writers in the business sector are increasingly using computers. To help determine the extent of automated communication techniques in Texas, I surveyed about 50 technical writers.

Methods. I compiled a mailing list of about 150 technical writers from a Society of Technical Communication membership roster which represented cities such as Houston, Dallas, Fort Worth, San Antonio, Austin, and Amarillo. Since in most cases the company employing the writer was not indicated on the roster, I requested on the questionnaire (see Appendix C, p. 23) that each respondent denote their company to prevent duplication of results. Respondents using computers for any phase of the production or processing of technical reports were to answer section A; others, section B.

Results/Analysis. I received 50 replies to the survey--about a 33% return. In a couple of instances more than one respondent was employed by the same company, yet none of the replies were counted as duplications because of the diversity of computer applications by different departments of the same company.

Of the 50 responses, 35 addressed question A1, noting that they used computers in some phase of their work. The following is a breakdown of the responses to A1 (refer to Appendix D, p. 24 for a list of the system names and complete results):

proofreading-- 7	typesetting--24
text editing--17	text processing--29
graphics--18	other-- 7.

That text processing received the most responses was not surprising, given the popularity of word processors which fall under that category. Some of the systems listed under text processing, however, possess editing capabilities, so I suspect that more than 17 respondents use their system for text editing. My incorrect use of the phrase "text editing" in question A3 possibly caused that confusion. Applications listed as "other" were preparation of parts list, quote generation, complex equation typing, information storage and retrieval, and interfacing with the New York Times information service.

The technical publication departments averaged using computers for 4½ years, ranging from 6 months to 13 years. Thus, computers seem a relatively new endeavor for those groups. As I noted earlier, question A3 caused some confusion, since "proofreading" would be more correct in that context than "text editing." However, some interesting comments

appeared with this question. One editor said that editing by computer seems inferior because the editor can not compare on the screen at the same time the original and edited texts. I must note here, though, that some VDT units allow for temporary comparison between the original and corrected texts. Corrections appear on the bottom of the screen as they are typed and replace the original text only after an insert command is given.

Another comment on question A3 relates to question A4. The respondent said that editing on a computer is superior, except when handled by inexperienced personnel. Since computer use in the technical writing departments surveyed is fairly recent, few writers or editors already in those groups are likely to have a great deal of experience with the equipment. In question A4, 20 responded that little or none prior knowledge of computers was required of their technical writers. Yet, as those groups become more adept with the systems, a much greater difference will be noted between the productivity of veteran users and inexperienced personnel. A study by Crook evidences that editing on a VDT by novices is slightly slower and more prone to error than editing on paper (10, pp. 14,46). Also in question A4, three writers said their departments preferred training and three writers said their departments required knowledge of computer language. I will elaborate on the educational significance of this in the next section.

Of the 12 replies to question B, two said their departments were considering future use of computers. Ten indicated their departments were not considering future use: four because of the small work load,

one because the organization trains writers rather than produces publications, and five for other reasons--including three who free-lanced and two who were unaware of the computer applications in technical communication. Unanswered questionnaires were returned from two professors and from one writer employed by the government and not able to disclose the information requested.

Discussion

Certain aspects of the survey discussed warrant consideration of what training with and knowledge of computers may be required of technical writers in the near future. A comment recorded on one questionnaire should prompt technical writing educators to reevaluate their programs: "industrial usage is far advanced in comparison to educational resources and practices." The following section views those educational resources and practices in light of the technology entering communications.

EDUCATIONAL IMPLICATIONS

Literature Review: Educational Responses

Technical Communication. Little is published in the various technical communication journals about whether and how technical writing educators are responding to industrial usage of computers in communication. This may stem from the general chaotic state of many technical writing programs--as described by Sullivan (11)--or a lack of awareness and incentive. Or, perhaps, educators are not convinced that computer instruction has a place in technical writing programs and courses. One reason why a clear-cut need for computer instruction did not develop when

computers first entered the publication process is that, originally, a computer specialist intervened between the computer and the communicator. As early as 1969, though, writers and editors began to realize that the computer specialist would eventually be eliminated from the publication process (12, p. 25; 13, p. 63). The communication process grows less efficient as more people handle the information, especially when someone from an unrelated discipline handles the information. Further, a writer or editor who works directly with a VDT exerts more control over the finished product.

Lone and Gourley stress that the student in technical communication should learn about computers' relation to technical communication (14, p. 67; 15, p. 85). A writer who understands, or at least is aware of, the possible applications of computers to technical publication has powerful tools within reach.

Journalism. Since computer use in journalism so closely parallels that in technical communication, the difference in the two disciplines' responses is worth noting.

When a few technical writers were just realizing the need for computer instruction in technical writing programs, journalism educators were responding to the introduction of computers in their field. In 1964, Danielson directed his students in producing a newspaper edited by computer (16, p. 43). Ten years later, Garber reported on a survey of 61 journalism schools which was designed to determine the extent of technology available for instructional use. The following sums the relevant points of his findings:

1. 37(63.8%) had access to photocomposition equipment;
   6(12.1%) planned to have access by 1976

2. 17(29.3%) had access to VDT units;
   19(32.8%) planned to have access by 1976

3. 13(22.4%) had some form of computer-assisted instruction;
   11(19.0%) planned to have CAI by 1976

4. 5(8.6%) used computer analysis of reports;
   10(17.2%) planned such use by 1976 (17, pp. 12-13).

Those statistics are important for two reasons. First, they represent the availability of equipment. Access to equipment occurs through three routes: either the departments own the equipment, the departments share equipment with the campus computing center, or the departments arrange with local businesses to share off-campus equipment. Technical communication programs unable to afford computer equipment do have viable alternatives. Second, the statistics illustrate the range of possible uses for the equipment. CAI, computer analysis of reports, and even departmental typing and bookkeeping tasks can be handled by the same system used for editing instruction.

Other studies in journalism which relate to the impact of technology include funding for VDT equipment, and the effect of VDT's on student editing (18, 10).

Survey of Technical Writing Educators

To learn of recent educational responses to computer applications in technical communication, I surveyed 20 technical writing professors from major schools across the country.

Methods. The questionnaire consisted of the following questions:

1. Does your University's technical writing course or program include instruction in computers?

2. If so, briefly describe how such instruction is implemented.

3. If not, (a) why? (b) are you considering or planning future instruction?

Results/Analysis. Fifteen of the 20 surveys were returned-- perhaps an indication of strong interest in this aspect of education. Six professors replied that their course or program includes computer instruction; nine, that theirs did not (see Appendix E, p. 26). The instruction is implemented in three ways, each which might be viewed as a possible method for a program to adopt. One method offers instruction outside of class on a text-editor/formatter. The professor citing this method did not indicate the extent of the instruction or the degree to which it is structured. The effectiveness of informal instruction would depend largely on those two factors.

A second method offers computer instruction through required computer courses. Three professors use this method, which probably is the easiest to implement since it only consists in requiring students to take programming courses. A problem arises in this method, though, in that programming courses usually do not cover computer applications. A more beneficial approach for students in technical communication includes communication-related computer instruction within the communication program itself. The third method indicated on the survey involves that type of instruction. One technical writing program offers four humanities courses which may include some sort of computer instruction: Publication

Management and Print Lab (include text processing instruction), Technical Writing (one formatted assignment), and a Senior Project (computer use available, but optional). Another technical writing professor will use an instructional grant to develop a two-week introduction to computer text editing in a writing/editing course. This type of hands-on instruction will prove most valuable to the student in the long-run, although it does require much commitment and effort from the program.

The professors noted a variety of reasons for not including computer instruction in their course or program. The most frequent explanation (given by three professors) was that the technical writing course emphasized improving student writing skills, rather than training technical writers. Two professors offered no explanation, and two cited a lack of awareness or initiative. One teacher said that students can not afford the computer time, which itself is limited. Finally, one professor seemed to underestimate my meaning of computer instruction. He pointed out that computer literacy was encouraged for all undergraduates attending the university, thus those students find it a "small matter" to learn a text editing program. Three of those courses or programs are considering or planning future computer instruction; six are not.

CONCLUSION

Summary/Interpretation

The use of computers in technical communication is altering the communicator's role in the publication process. VDT's, photocomposers, and automated information transmitters provide the communicator with

greater flexibility and control, while demanding of the communicator an adeptness with the equipment. The literature strongly supports the need for technical communicators to learn about the computer applications in their field. Yet, the response of most technical writing educators, unlike their journalism counterparts, has been slow. Some, however, have begun to take steps in updating their program. Updating of instruction is imperative for a program to benefit students in the long-run.

Recommendations

Based upon the literature's emphasis on computer applications in technical communication, and upon the results of the two surveys, I submit the following recommendations for technical writing educators:

1. Technical writing educators, even if their course objective does not include training technical writers, should learn about the communication-related applications of computers to broaden and update their conception of technical communication.
2. Technical writing educators who are committed to training technical writers should closely examine journalism's response to technology.
3. Those developing technical writing programs should study the feasibility of the various methods of incorporating computer instruction into the programs. Considerations might include the goals of the program, and the availability of equipment and qualified teachers.

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APPENDIX

A. Publication Process
B. VDT's and the System
C. Questionnaire to Writers
D. Results--Survey of Writers
E. Results--Survey of Educators

A. Publication Process

Traditional	Automated
1. Write draft	1. Write draft
2. Type draft	2. Enter text on VDT
3. Proof/edit draft	3. Proof/edit on VDT
4. Retype edited copy	4. Enter layout codes
5. Proof for typos	5. Print (compose)/ distribute
6. Send copy to printer	or
7. Printer sets type	Send via automated transmittor to print at destination.
8. Galley proof is printed	
9. Galley is proofed/ "cut and paste" for layout	
10. Printer resets type	
11. Page proof is printed	
12. Page proof is checked for text/layout errors	
13. Blueline is printed	
14. Blueline is proofed	
15. Final copy is printed/ distributed	

B. VDT's and the System

A VDT unit comprises a typewriter-like keyboard and a display screen, or cathode ray tube (CRT)--see Figure 1. Depending on the unit's special features, a VDT's keyboard varies in complexity (Figure 2; Figure 3, p. 21). The editing capabilities of a VDT, however, do not depend on the complexity of the keyboard. Software, in the form of programming codes, readily substitutes for almost any special key.

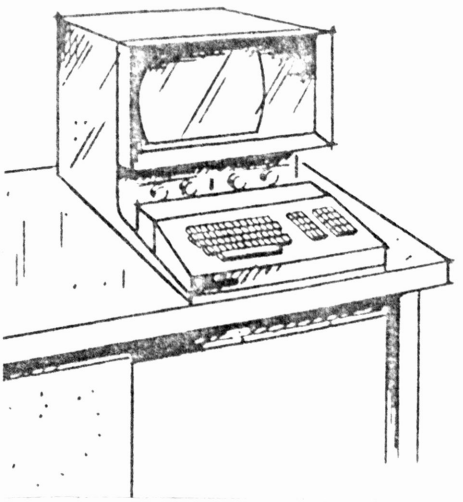

Figure 1. Video Display Terminal.
Source: Berman, p. 219.

A VDT may either "stand-alone" or operate "on-line." A stand-alone unit contains its own minicomputer, enabling it to handle small data processing tasks. Unless the VDT is

Figure 2. Compuedit keyboard.
Source: Moghdam, p. 99.

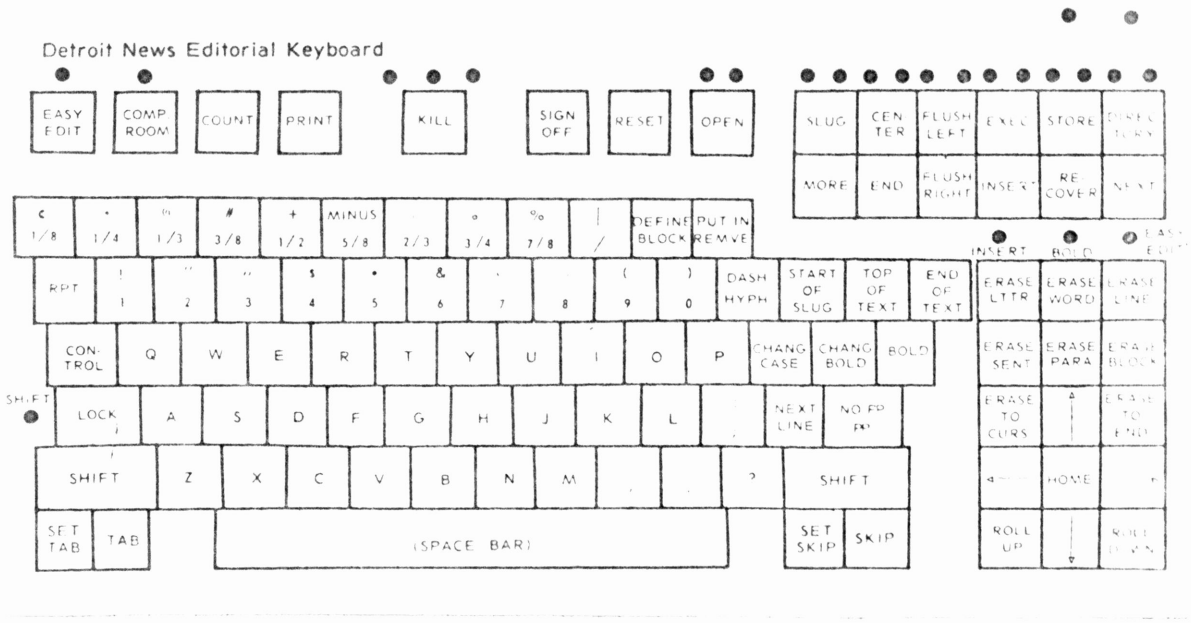

Figure 3. Detroit News Editorial Keyboard.
Source: Moghdam, p. 75.

linked to a larger system, the VDT output must be stored in some physical form (paper tape, magnetic tape, floppy disk) and then entered into a large system which reads the information off the tape or disk, thus directing a printer or photocomposer. Typewriters equipped to produce some magnetic output are also considered stand-alone devices, although they lack the processing capabilities of VDT's.

On-line VDT units share the central processing unit (CPU) of a larger system. The VDT's may connect to a minicomputer and printer (Figure 4, p. 22), or to a larger computer, printer, and photocomposer (Figure 5, p. 22). The advantages to on-line processing include increased processing and storage capabilities. However, if the CPU fails, the whole system--including the VDT's--is inoperable (2).

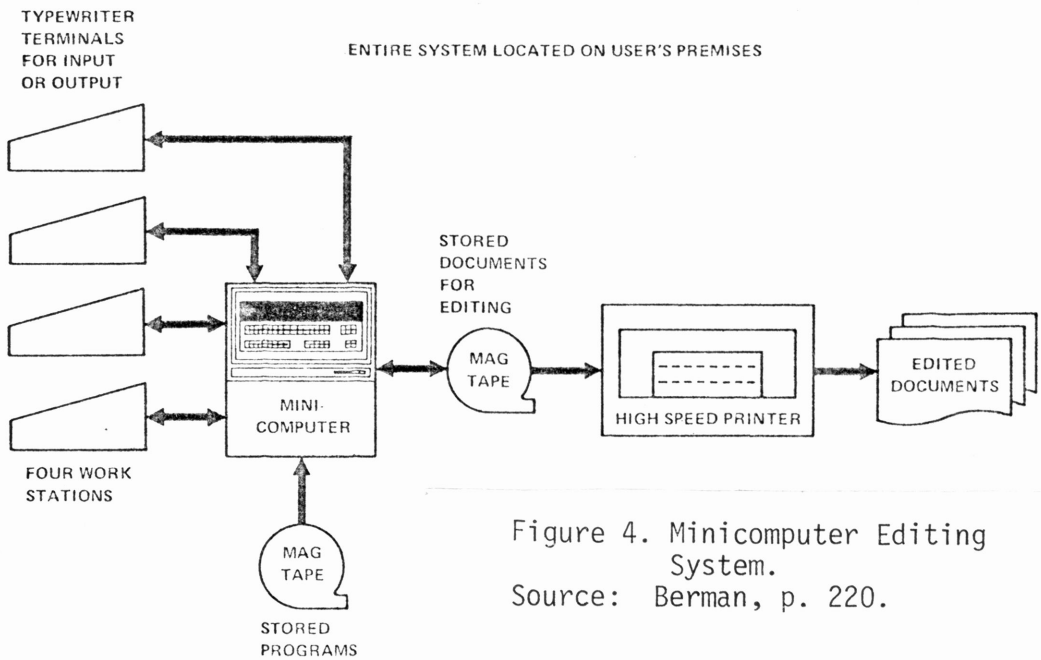

Figure 4. Minicomputer Editing System.
Source: Berman, p. 220.

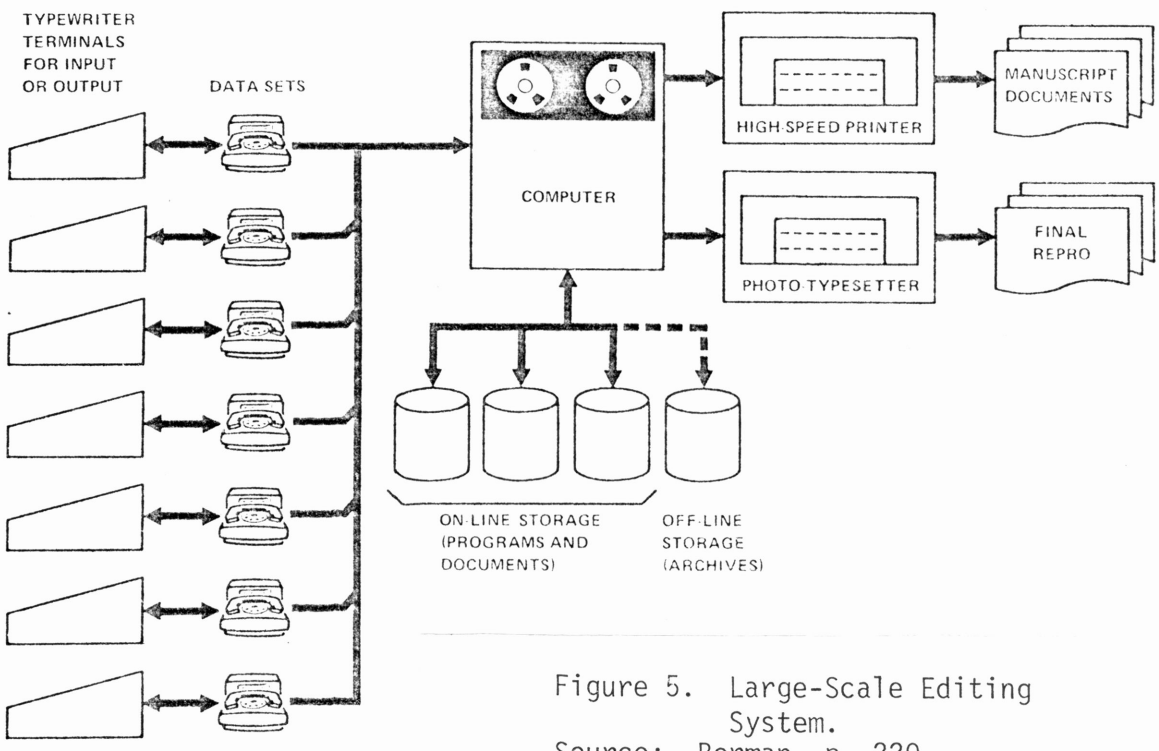

Figure 5. Large-Scale Editing System.
Source: Berman, p. 220.

C. Questionnaire to Writers

If your technical writing department uses computers for any phase of the production and processing of technical reports, please answer Section A. Otherwise, please answer Section B.

Your company's name:_____
(This is vital in order to avoid duplication of results.)

A. 1) Please indicate how the computers are used, and if possible, the name of the system:

____proofreading:_____

____text editing:_____

____graphics:_____

____type setting:_____

____text processing:_____

____other:_____

2) How long has your department used computers?_____

3) If your system handles text editing, do you consider that method (a) equal to, (b) superior to, or (c) inferior to the text editing of humans?
Why?_____
_____
_____

4) What, if any, prior knowledge of computers does your department require of its technical writers?_____
_____

B. Is your technical writing department considering computers as a future addition to the work force? yes no
If not, is it because (a) computer use is not feasible because of the relatively small work load, (b) computer use is not feasible because of the nature of the work (please explain), or (c) other (please explain)?
_____

D. Results--Survey of Writers

Of the 50 replies received, 35 addressed question A1. The numbers in parens refer to number of responses.

A1. Distribution of replies and system descriptions.

7	proofreading:	Compugraphic Editwriter 7500, IBM 370, Conversational Monitor System (CMS), Daconics (2)
17	text editing:	Linolex, Lexitron, TI 990, DX10 Text Processing, CPT 8000 Word Processor, IBM System Six, IBM 370, CMS, Daconics (2), IBM 3730, Compugraphic Editwriter 7500, Wang, Xerox
18	graphics:	Computer Aided Drafting System, Computervision, Illustromat 1100 & 1200, TI 990, Genigraphics, IBM 370, Integrated Graphics Design System (4), Digital Equipment Corp. PDP-11/70, Cromemco System 3, IBM--CADAM & ATMS II
24	type setting:	TI 960 A/B, Compugraphics, ITEK Graphics (2), Quadritek 1201, IBM 370, Daconics (3), FASCOMP--Harris CRT, Comp. 80 III with ATMS II--IBM, Xerox, AM Compset 500, IBM Electronic Composer, Wang
29	text processing:	64K TI 960B, TI 640, CPT 8000 Word Processor, IBM Mag Cards, CMS, Edit/Set II Addressograph/Multigraph, IBM System Six, IBM 370 (2), Daconics (4), 3M Linolex Word Processor (2), Xerox 850 (2), Lexitron 942 & 1102, Wang (2), Xerox, AB Dick Magna II
7	other:	New York Times information service, information storage and retrieval, parts list preparation, quote generation, memory typewriter.

2. Length of computer use: Ave. 4½ years; Range 6 months-13 years.

3. Text editing considered (a) equal to, (b) superior to, (c) inferior to that of humans: (a) 6 (b) 7 (c) 2.

4. Prior computer knowledge required: Little or none--20, Prefer training--3, Must know language--3.

B. Technical writing departments considering computers as a future addition? yes 2 no 10.

If not, reasons (a) computer use is not feasible because of relatively small work load, (b) computer use is not feasible because of nature of the work, or (c) other: (a) 4 (b) 1 (trains report writers) (c) 5 (including three free-lance writers and two who indicated lack of awareness within department on computer applications.

E. Results--Survey of Educators

Below is a summary of the 15 replies received (20 surveys distributed). The numbers in parens refer to the number of responses.

1. Does your University's technical writing course or program include instruction in computers? yes (6) no (9)

2. If so, briefly describe how such instruction is implemented:

   --by instruction outside of class on text-editor/formatter (1).

   --by required courses (3). Descriptions:
   (1) brief computer course in freshman year and strongly recommended formal computer course before graduation.
   (1) mandatory computer course (one more to be added later).
   (1) two required courses in programming and strongly recommend learning to use word processing equipment.

   --by communication-related computer instruction (2). Descriptions:
   (1) four humanities courses--Publication Mgmt. (text processing introduction); Print Lab (text processing segment included); Tech-Writing (one formatted assignment); Sr. Project (computer use available, but optional); miscellaneous Computer-Aided Instruction programs.
   (1) A small instructional grant will enable this teacher to work with the university Computing Center to develop a two-week introduction to computer text editing in a sophomore-level writing/editing course. The instruction will involve hands-on experience with an interactive terminal and batch printing.

3. If not, (a) why?

   (3) technical writing course not designed to train technical writers, rather to improve writing skills.

   (2) no comment.

   (1) computer science program new to the campus, and the instructor lacks knowledge of computers. Also, unaware that such knowledge was a high demand topic for employers.

   (1) unaware that use of computers was possible or useful in a technical writing course. Also, unlikely the university could afford the equipment for the program.

(1) most students cannot afford the computer time, which itself is limited.

(1) computer literacy encouraged among undergraduates, for whom it is a small matter to learn a text editing program.

(b) are you considering or planning future instruction?
yes (3) no (6).