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ABSTRACT

Information systems for the sciences and professions should differ from those of traditional libraries because their purpose is to disseminate information, not to archive it, and their holdings should reflect user needs, not the size of the knowledge base. Various information system models may be identified, such as the discipline-oriented, the field-oriented, and the problem-oriented. The Educational Resources Information Center (ERIC) is an example of a field-oriented system, and the major portion of this paper is devoted to discussion of its objectives, accomplishments, and failures. ERIC has been successful in fulfilling objectives of: (1) collecting, abstracting, indexing, and making available the significant literature in the field of education, and (2) preparing reviews and syntheses to place the literature in perspective. A third purpose has remained largely unfulfilled; that is, bringing the ERIC knowledge base to the attention of practitioners. The decisions to model ERIC services after a traditional scientific information storage and retrieval system and the large reliance on microfiche to make information available to users are questioned. Alternate procedures are suggested and outlined. (NH)

IMPROVING AN "ERIC-LIKE" INFORMATION SYSTEM

William Paisley

Stanford University

June, 1971

(If he has strong prejudices, a "retiring" ERIC clearinghouse director is likely to write a position paper like this. The author hopes that his suggestions for improving ERIC do not misrepresent his respect for the system and his affection for the people who run it.)

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This is a period of rapid growth in information systems for the sciences and professions. Information centers are springing up across the country. Federal agencies and private groups are both collaborating and competing to establish comprehensive systems.

Changing the library's name to "information center" is more than linguistic faddism. New, active roles subordinate the library's traditional, passive role as a preserver and codifer of knowledge. "Information center" bears analogy to "economic center" and "transportation center." Like these centers, its significance lies in transaction. The significance of a transportation center lies in routes to other centers. The significance of an information center lies in communication lines to knowledge producers and knowledge users. Information centers are judged by their information "throughput," not by their "holdings."

The traditional library has an excellent network of incoming lines but few outgoing lines. This pattern complements it archiving

function. In fact, since lines cost money, a well-developed outgoing network takes resources away from the archive.

The holdings of a traditional library are determined by available funds plus the size of the knowledge base -- the number of books and other documents that can be acquired. An information center's holdings must also reflect available funds, but not the size of the knowledge base. Instead, an information center's holdings should be precisely adequate to maintain the flow of information that its users need, whether their needs encompass a large or small proportion of the knowledge base.

The difference between what an information center can acquire and what it should acquire is brought out in Recommendation B5 of the report of the Committee o Scientific and Technical Information of the National Academy of Sciences:

> "Each society or association, the membership of which includes many persons concerned with practice, especially in engineering, medicine, and agriculture, should increase substantially its attention to information programs that will:
>
> 1. Ensure that access, awareness, and appraisal services comparable to those supplied for th dy research literature are provided also for publications of particular interest to the practitioner, such as textbooks, monographs, handbooks, manuals, patents, trade journal publications, company reports, catalogs, specifications, and standards
>
> 2. Stimulate the production of critical reviews and surveys of contemporary fields of knowledge, the condensation being focused on particular domains of application of interest to the practitioner and adapted to his needs
>
> 3. Identify types of data banks, including diverse types such as Sweet's Catalog, the Chemical Compound Registry (of Chemical Abstracts Service), and the Thermophysical Properties Research Center at Purdue, which need to be

established in a field; establish or foster the creation of required data banks; and provide an indexed inventory for existing ones that describes coverage and conditions of access

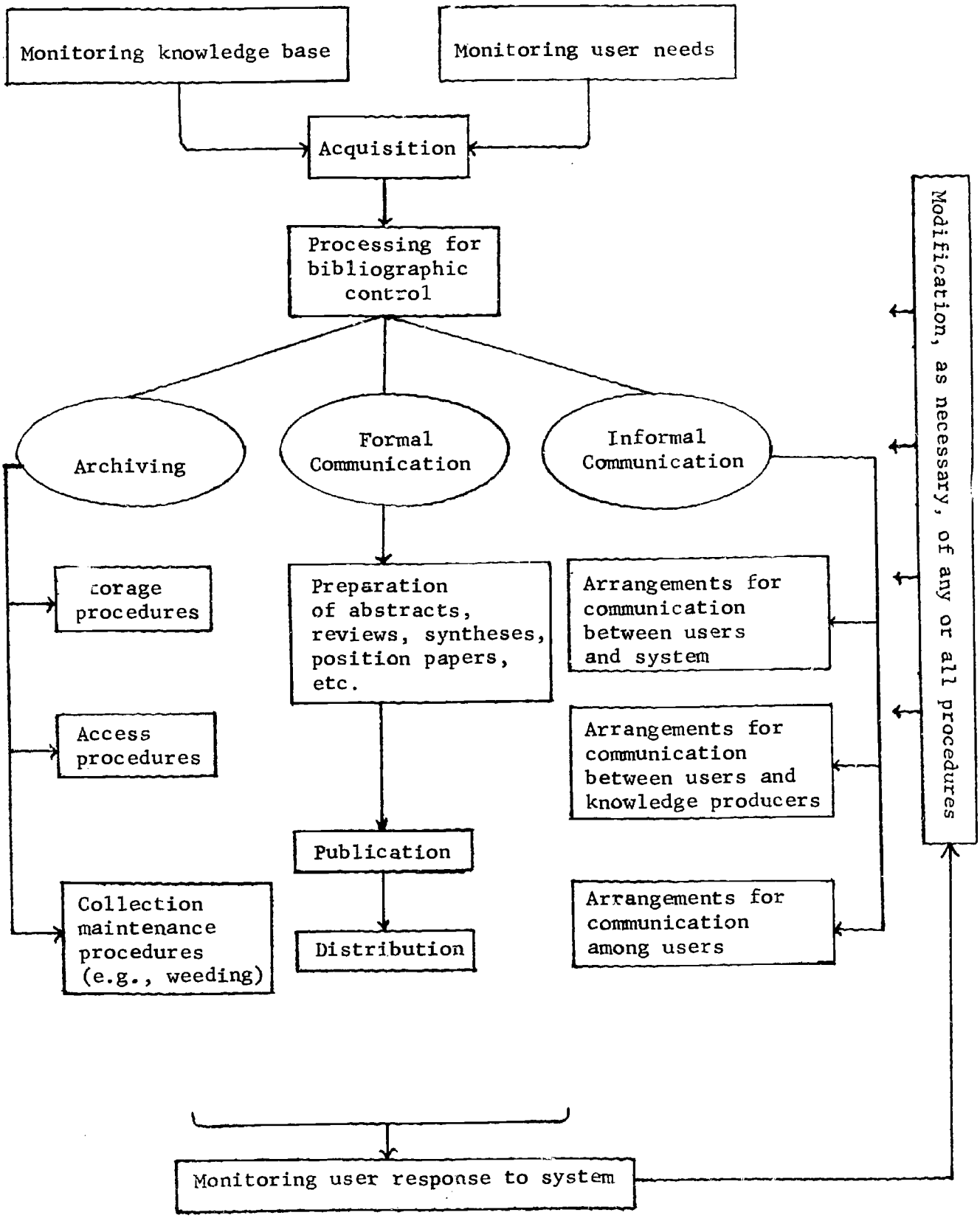
4. Meet the needs resulting from requirements of continued education to keep practitioners in its field up to date."

Of all scientific and professional groups, "practitioners" (physicians, educators, engineers, etc.) are worst served by information systems whose holdings reflect what is available rather than what is needed. To the practitioner, if not to the archivist, one handbook or manual may be worth more than a hundred research reports.

Thus an information center should differ from a traditional library in two respects: (1) it should exist to disseminate information, not to archive it; (2) its holdings should reflect user needs, not the size of the knowledge base.

The term "information system" denotes physical and human resources for performing a full range of information functions (see Figure 1). An information center is usually one of several subsystems that together form an information system. Although an information center could be comprehensive enough to qualify by itself as a small information system, more typically the information system of a scientific field or profession combines specialized-function or specialized-audience subsystems, and these are variously under federal, commercial, and professional control. Information centers sponsored by federal agencies, books and bibliographic

Figure 1. Simplified flow-chart of information system functions.



services published by commercial publishers, and journals published by professional societies are interdependent subsystems typically found in a present-day information system.

There is no "right way" to form an information system from subsystems that perform different functions, serve different audiences, or both. Each scientific field and profession has valid historical reasons for some (but not all) of the idiosyncrasy in its information system. For example, the emerging biomedical information system reveals the strong centralizing influence of the National Library of Medicine. The emerging educational information system reveals the absence of a National Library of Education. The two systems must provide comparable "throughput" of information, despite great differences in the organization of knowledge resources in the two fields.

Plans for future information systems may have to accept as "givens" the historical accidents that provide a field with a National Library, a strong professional society, a vigorous commercial publishing arm, etc. Although, strictly speaking, no subsystem in an information system is unchangeable, nevertheless it is unrealistic to plan on the establishment of a new National Library, the revitalization of a weak professional society, etc. In any developing information system, change in some subsystems is not worth the effort. Conversely, some subsystems are easily changed, and new subsystems can be invented.

In planning an information system for any scientific field or profession, we must therefore distinguish between characteristics

that have a valid historical basis and others that "just happened." The former characteristics, after due consideration, may have to be accepted as design constraints. The latter characteristics provide latitude for change.

The less fixed subsystems of an information system can evolve through de novo variation, through adoption of structures and functions that have been tested in other information systems, or both. As the average sophistication of information systems rises, the adoption of precedents will be clearly preferable to de novo change. It will then be a matter of identifying model systems and useful precedents within them (versus the residual idiosyncrasy found in every system).

The discipline-oriented information systems of physics, chemistry, and psychology are models because of the thought, research, and innovation that is going on within them. As coordinated by the American Institute of Physics, the American Chemical Society, and the American Psychological Association, these systems provide information from disciplinary knowledge bases, regardless of the user's field of application. Like other discipline-oriented systems, they are building upon a history of journal publication. Neither archiving nor informal communication was their original strength; they seek now to understand and encompass these subsystems.

The field-oriented information systems of medicine and education turn the coin. As coordinated by the U.S. Public Health Service and the U.S. Office of Education, these model systems draw upon

field-based knowledge to serve users from diverse disciplines. For example, the educational information system, ERIC (Educational Resources Information Center), draws upon the educational knowledge base to meet the information needs not only of educators but also of psychologists, sociologists, economists, linguists, engineers, architects (etc.) who happen to be working on problems within the field of education.

These systems (particularly the medical system, centered in the National Library of Medicine) are building on experience in archiving information. Their challenge is to open lines of formal and informal communication that are in touch with user needs. More than the disciplinary systems, the medical and educational information systems try to meet information needs of practitioners as well as researchers.

A third model is that of the problem-oriented system. The Department of Defense, the National Aeronautics and Space Administration, and the Atomic Energy Commission sponsor numerous information centers that serve neither disciplines nor fields but rather specific problem areas. For example, the Atomic Energy Commission supports that Fused Salts Information Center in Albuquerque while the National Bureau of Standards supports the Molten Salts Data Center in Troy. Sponsorship of the Air Force Machinability Data Center, the Defense Ceramic Information Center, and the Defense Metals Information Center is clear, but it is less obvious that the Arctic, Desert, Tropic Information Center, the Cultural Information Analysis Center, the Mechanical Properties Data Center, the Shock

and Vibration Information Center, and the Thermophysical Properties Research Center (among many others) also have support from the Department of Defense. Most such centers were started within the past ten years. They may reflect a new pattern in the organization of knowledge resources; the discipline-oriented and field-oriented models are much older. However, it is more likely that these centers reflect the funding discretion of a few agencies that can proliferate problem-oriented centers if they want to.

Orientation to discipline, field, or problem is one dimension on which model information systems should be compared as we look for useful precedents in structure or function. Centralization of resources is another dimension. Centralized resources permit efficient document processing, but they may be less accessible to users than decentralized resources held in regional centers.

The mode of communication that an information system emphasizes is a third dimension for comparison. Existing systems have never dealt as successfully with informal communication as they have with formal communication. That is, they have not facilitated direct communication between knowledge producers and knowledge users, or between users with similar problems, but they have performed well as publishers of information in the traditional sense. In many cases they have developed new information formats to make publications more accessible and more timely.

At this moment in the history of information system development, momentum and attention are shifting to informal communication modes. Schemes as ambitious as the "on-line intellectual community" capture

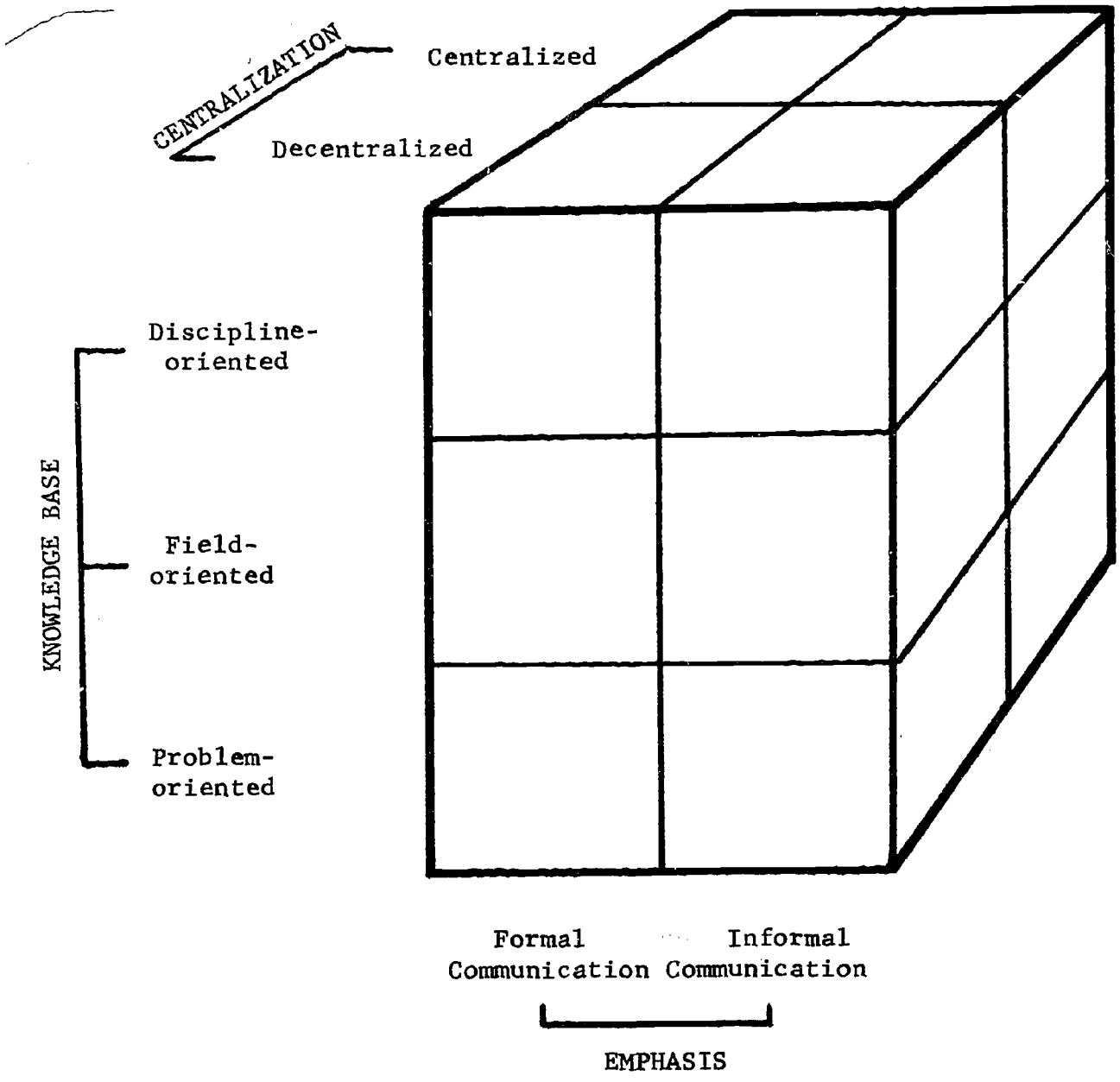
the imagination of users, while practical schemes (such as preprint exchanges, directories of "experts," and small symposia) are being field-tested with less fanfare.

Nevertheless, an informal communication subsystem cannot assume all functions of a formal communication subsystem. A preprint is different from, and cannot replace, a refereed journal article. In the mid-1960's, when informal communication subsystems were not yet being planned for information systems, we had to point out that formal communication is deficient in timeliness, relevance, immediacy, and two-way flow. Now that the pendulum is swinging in the other direction, it is time to defend the formal subsystem and its unique timelessness, universality, "democratic" access, and user control of use.

Figure 2 shows how the dimensions of orientation, centralization, and communication mode combine in a matrix of possibilities for information system development. Some of the 12 combinations make better sense than others, but all might be considered for a particular application.

The remainder of this paper will discuss one model information system, the Educational Resources Information Center. ERIC's strong subsystems are precedents that information system planners should consider adopting or adapting. At the same time, like all systems that break new ground, ERIC has weak subsystems -- "negative precedents" -- that system planners should also be aware of.

Figure 2. Matrix of possibilities for information system development.



After four fully operational years, the ERIC system has succeeded in two important missions and failed in a third. ERIC's founding philosophy called for: (1) collecting, abstracting and indexing, and making available the significant literature of the field of education; (2) preparing reviews and syntheses to place the literature in perspective; (3) bringing the ERIC knowledge base to the attention of practitioners, so that educational practice might catch up with its own best exemplars.

Objectives (1) and (2) have been accomplished in fine order. ERIC can take pride in saving much of the educational report literature, generated so prolifically after the passage of the National Defense Education Act, from oblivion. A researcher can now be confident that ERIC will hold and disseminate the research reports that once disappeared after their small press runs were used up.

The preparation of reviews and syntheses has also proceeded in a thoroughly professional and useful manner. Every ERIC clearinghouse has a file of letters bearing unsolicited praise for the information analysis program it carries on.

However, the third objective -- bring the ERIC knowledge base to the attention of practitioners -- has eluded ERIC's outreach efforts thus far. Even knowledge of ERIC's existence declines abruptly as we move from "cosmopolite" researchers and professors to "localite" administrators and teachers.

We could argue that ERIC accounts for no measurable change in educational practice across the United States. The argument is

unfair; people, not information systems, "do" education. Still, knowledge of ERIC at the local level must precede the use of ERIC's resources in local decision-making, and studies show that knowledge of ERIC is a sometime thing.

ERIC's first mistake in system planning was that of adopting a scientific information system model. The disciplinary information systems of science emphasize formal communication because they are typically responsible for "certifying" (refereeing) the literature as well as disseminating it. No scientific or professional group has ever been found (in information-seeking studies) to prefer print sources over the information and advice that colleagues provide, but scientists who use disciplinary information systems are at least more print-oriented than technologists and professionals. Scientists can be described as "print-tolerant," and that is more than can be said of physicians, educators, engineers, etc. Of course every educated person in this society can and does read a great deal, but the latter groups rely heavily on colleagues and co-workers to keep them informed on developments within their professions.

Researchers who study information-seeking have various interpretations for the extent to which all scientists, technologists, and professionals rely on interpersonal rather than print sources. One interpretation emphasizes the role of colleagues as "relevance filters." Another argues that the most worthwhile information is not to be found in print anyway -- for example, methodological details that are notoriously lacking in journal articles. A third

interpretation stresses the exchanges of information for esteem that George Homans treats in his social reinforcement theory. And so on -- the finding is so pervasive that many interpretations have been ventured.

It is ironic that, just when practitioner-oriented ERIC was adopting a traditional scientific information system model, various scientific information systems began to experiment with informal communication modes that would have appealed to practitioners. For example, the American Psychological Association introduced several innovations to encourage direct exchange between knowledge producers and knowledge users.

However, it is possible that neither the traditional model (emphasizing formal communication) nor the "progressive" model (striking a balance between formal and informal communication) would have been right for the field of education. Given the high priority that has subsequently been placed on creating awareness and interest practitioners in the local education agencies, two radically different models might have come closer to meeting this objective.

One alternative model is that of a continuing education system. It would have three founding premises: (1) developments in the field of education can be "packaged" as in-service courses for administrators and teachers (presumably the same courses could be used for pre-service training in schools of education); (2) obligation or motivation exists for administrators and teachers to participate in continuing education; (3) the costs of preparing

course materials and conducting the courses could be borne by Washington alone or by Washington and other sponsors.

The first premise is suspect if we think in terms of a scientific knowledge base. Obviously the current literature of physics or chemistry cannot be packaged in a manageable number of courses. Even doctoral students in these disciplines are exposed to only a fraction of the knowledge base.

However, educational knowledge does not fit the scientific model. Relatively few research findings, curriculum developments, arrangements for teaching and learning (etc.) need to be highlighted from the buzzing confusion of educational research, development, and practice. If 40 hours of coursework were to be devoted exclusively to "new developments in the field of education" (that is, one hour per week during the school year) it is clear that administrators and teachers would be far more cognizant of important trends than they are now.

An alternative to the model of continuing education is the model of formalized consulting arrangements. Educators now use each other as informal consultants, and some states have had salaried consultants in such areas as Title III proposal preparation, the planning of vocational and technical education, etc. The states and many localities also have research offices responsible for interpreting research as well as performing it.

However, there is a missing professional role that could be very effective in reaching local practitioners. The role is analogous to that of the County Extension Agent in agriculture, but

without any service comparable to soil testing. An educational extension agent would be very familiar with knowledge resources in education. His own system (the archival side of ERIC) would be adapted to his needs as a relayer and interpreter of trends. That is, the ERIC knowledge base would be stratified by levels of significance for current educational practice. In spite of a sharp "interest peaking function" among practitioners, ERIC presently stratifies its knowledge base less than the disciplines of physics and chemistry, where tough-minded reviews damn by discussion and omission alike.

We can't prejudge the merits of a continuing education system or a consulting system in lieu of the present traditional information system. It is enough to point out that ERIC may yet develop along these lines and that the objective of reaching local practitioners may be more nearly fulfilled.

Any apparent discontinuity among these "information delivery" models can be explained by the traditional roles they occupy in our society, not by the information functions they perform. In terms of information functions, they are very complementary systems, differing only on the dimensions of currency, depth, the extent to which information is pre-screened, etc. There are in fact four generic information delivery systems:

1. Current awareness. Characterized by a shallow knowledge base of high currency. Items are regularly superseded by more recent (not necessarily more significant or valid) information.

Delivery accomplished through newsletters, broadcasts, and other recurrent formal modes, but also through conversation and direct observation.

2. Consultative. Highly selected and evaluated information is relayed by someone whose specialization or responsibility differs from that of the person being informed. The consultative system imposes criteria of significance and validity as well as recency. Unlike the current awareness system, the consultative system will reinstate older information if recent information lacks significance or validity. Experiments with computer question-answering systems suggest that mediated consultation is coming, but presently the consultative system relies upon face-to-face and telephonic conversation, together with correspondence.

3. Instructional. The instructional system covers a deeper and broader knowledge base than the current awareness and consultative systems. It has the advantage of replicability and disadvantages of fixedness and serial presentation. For example, a continuing education course can be repeated any number of times (for economy, it can be committed to film or videotape) but it is difficult for the student to recombine information inputs around the focus of his interests or to ask the system for more information than has been programed into it.

4. Information storage and retrieval. This system provides greatest depth and breadth at the cost of difficult access. The entire knowledge base is potentially encompassed, but evaluation is minimal and purging of obsolete knowledge is the responsibility of the user, who causes obsolete items to be weeded by not requesting

them. Motivation to use the information storage and retrieval system must be high. Of the four generic systems, the information storage and retrieval system is least able to approach the user within his own cognitive world.

The decision to model ERIC services after a traditional scientific information storage and retrieval system can therefore be questioned.

A corollary fault in the present ERIC system could not have been foreseen at the outset. In order to make original documents available at reasonable cost, a microfilm archive was created. Most documents announced in the abstract journal, Research in Education, are made available in microfiche format (as well as expensive full-size reproduction) from the ERIC Document Reproduction Service. Recourse to microfilm was consistent with the decision to pattern ERIC after a scientific information system, since microfilm is used broadly, if not deeply, in information systems of the scientific disciplines.

The concept of microfiche is more attractive than its implementation, except in repetitive large-file applications (e.g., parts catalogs, business transaction records). It is almost impossible to browse through a microfiche file, since the gray uniformity of fiche headings provides few clues about the relevance and value of information contained on each fiche.

However, the worst aspect of a microfiche-based system is the reading device itself. While a microfiche may not inspire enthusiasm for reading as a handsomely printed book can, still it compresses 72 clear page images (standard COSATI format) on a four inch by six inch

card. In other words, given the difference that books can be pretty but microfiche only plain and utilitarian, we find that a microfiche at least livesup to its "advertising."

The same cannot be said of reading devices. Microfiche readers are astonishingly primitive examples of electro-optical technology. They are hot and often noisy in operation; their short-lived bulbs are expensive to replace. Their transports cannot hold a microfiche in focus from corner to corner. Moving a transport could be as simple and precise as moving the stage of a good microscope, but isn't. Finally, no manufacturer seems to have considered that a user wants to read two microfiche side by side (for simultaneous access to 100 or more pages, as when index entries are being checked in the text).

Those of us who participated in or watched the early development of the ERIC system believed that microfiche readers would soon be convenient and inexpensive devices. We felt that educators would be pleased to use them in their offices and faculty lounges. Such patterns of use have not appeared, yet we cannot fault educators for having as little as possible to do with machines that are now on the market.

If an information system is by necessity based on microfiche (a genuine "if" -- see below), then microfiche readers should meet these minimum specifications:

- Constant focus across transport
- Long bulb life
- Low heat and noise

- Simultaneous viewing of two fiche
- Motorized transport, with digital addressing of each page-frame location.

Nothing in these specifications goes beyond present technology, nor need the device cost more than $300. Well-founded resistance to the purchase of existing readers will disappear when the first adequate reader is produced.

Let's go back to "if an information system is by necessity based on microfiche . . . ." Certainly there is no economically feasible alternative if the system must distribute "raw text" to thousands of points of use. But is there significant benefit in such distribution? In a practitioner-oriented system, are original documents better than, or even as good as, alternatives such as long abstracts or extracts?

The experience of the American Psychological Association in publishing 1800-word brief articles in the Proceedings of its annual convention shows that users are well satisfied with an abbreviated version. They find within the two 8 1/2" x 11" typeset pages most of the facts they want to know. Equally important, authors often accept the 1800-word article as a (provisionally) final statement of their research; fewer of them seek to publish a longer version elsewhere than was true before the Proceedings format was introduced.

Another approach to the preparation of a long abstract or extract was proposed some time ago by the System Development Corporation in collaboration with the National Federation of Abstracting and Indexing Societies. It was a structured "technical progress summary" in

which some aspects of the research would be categorized (that is, by checking boxes on the summary form) and other aspects would be reported in a brief narrative. The advantage of the "technical progress summary" over the 1800-word brief article is consistency of content and presentation -- in particular, omissions of fact would be less likely to occur. The disadvantage is inflexibility in treating documents that depart from the research-report model.

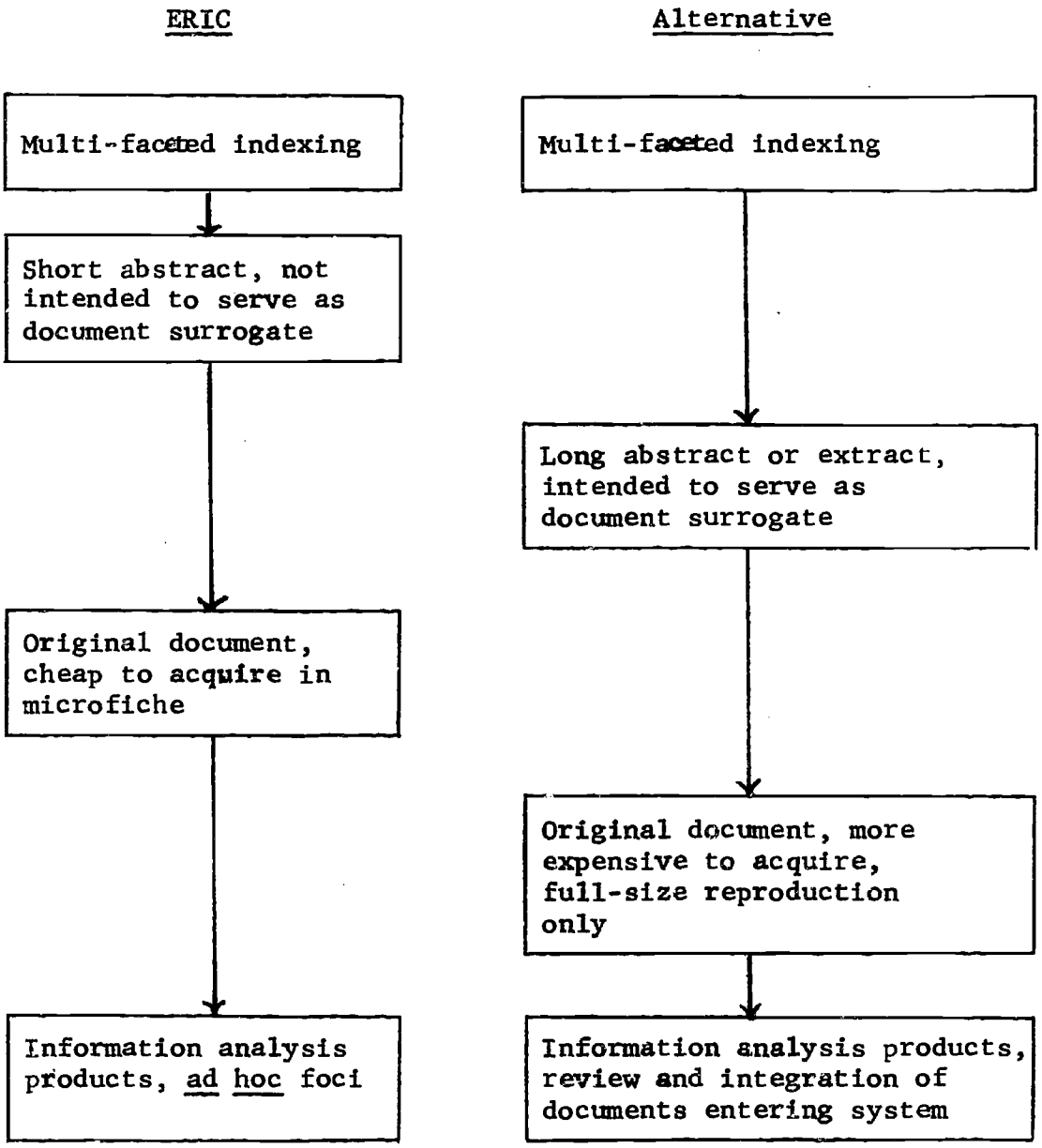
Figure 3 shows how the ERIC combination of short abstracts and cheaply acquired original documents differs from an alternative combination of long abstracts and more expensively acquired original documents.

More specifically, alternative procedures would be:

1. Documents would be screened for inclusion into the ERIC system. Because of a higher investment in preparing the long abstract or extract for each document, an informal input quota would be established below the present level (e.g., about 5,000 new documents per year, system-wide). Review of Research in Education shows that more stringent screening would not subtract much from the educational knowledge base.

2. Long abstracts or extracts would be prepared, following guidelines that systematize content and format. Either the APA 1800-word brief article or the SDC technical progress summary could be used as a model. The two models would probably converge in practice. A new, broadly applicable format would be developed that could serve other information

Figure 3. The ERIC combination of short abstracts and easily acquired original documents, and an alternative.



systems as well.

3. Instead of being microfilmed, documents would be held for xerographic reproduction on a demand basis. Since the long abstract or extract is intended to stand as the document itself in meeting the needs of most users, demand for full original text should be low. Ordinarily, only a handful of researchers would have enough interest in the full original text to request it. They would pay either a subsidized rate of 5¢ per page or an unsubsidized rate of 10¢ to 15¢ per page, the latter rates reflecting the high cost of demand-basis reprography. The cost of making such full-size copies available could be reduced somewhat by adapting the linear regression "demand estimate equation" that has been developed for the Defense Documentation Center and the National Technical Information Service. That is, factors related to the subject matter and to the nature of the document (e.g., synoptic review versus singular research report) provide a regression estimate of the probable 12-month demand for hard copy. The estimated number of copies is then made up in advance (the number rarely exceeding 25 to 50). These early copies could be made available more cheaply than later, singly produced copies.

4. Instead of the present pattern of ad hoc information analysis products that have little bearing on documents currently entering the ERIC system, information analysis funds would be devoted to a continuing review and synthesis of current documents,

with only a fraction of the funds set aside for papers on topics not reflected (or not yet reflected) in the documents, such as pending legislation and future trends.

Significant advantages of the alternative system might be:

- No microfiche
- Volumes on the user's shelf that contain the year's significant literature in synopsized form (assuming that one-third of the documents require two-page typeset 8 1/2" x 11" synopsis, and that the other two-thirds require only one-page synopsis, one year's issues of the new service would add up to 5,000 pages plus indices).
- Browsability in the ERIC system for the first time
- Substantial content in the system from documents that cannot themselves be included in the system. That is, long abstracts can be published of copyrighted material that cannot be provided by the ERIC Document Reproduction Service. Presently the gap between the short abstract and these often hard-to-obtain materials is much too wide, and the short abstract represents a dead end to the user who cannot acquire or borrow each copyrighted document separately.

Referring back to Figure 1, we can see that this alternative affects the archiving and formal communication subsystems only. The important and neglected subsystem of informal communication requires other structural and functional changes, some of which are suggested below.

First, it should be recognized that the decentralized character of the ERIC system leads to inefficiency in document-processing operations at the same time that it confuses users. Whenever functionally distinct elements are geographically dispersed so that they are located in the midst of populations of users, it is natural for users to expect or hope that the nearest element can perform all the functions of the entire system. That is, users in a geographical region naturally hope that "their" ERIC clearinghouse can perform searches across the entire educational knowledge base and provide on-site access to documents. A large amount of on-site user service is provided by clearinghouses, but the efficiency is comparable to selling automobiles one at a time from the assembly line in Detroit.

The purpose of decentralization was to locate appropriate information-processing activities in centers of subject-matter expertise. It is important, for example, that information analysis be conducted by specialists who are respected in their fields. However, the same factors that are counted as strengths in information analysis capability must be counted as weaknesses in on-site user service, except of course when users asks questions that fall within the subject specialty of a clearinghouse.

The confusion of subject specialty roles and regional service

roles should be overcome by providing users with direct general-topic access to the ERIC system. By analogy, access can be provided by setting up a "retail store" adjacent to the "factory," but the efficiency of operations performed by subject specialists will improve if the retailing takes place at completely different locations.

The concept of "local one-stop information centers," advanced by Burchinal in the early days of the ERIC system, has been adopted to a gratifying extent by some states and some localities. An example of such a center is the San Francisco Bay Area Information and Dissemination Center for Educational Materials. There is reason to believe that such centers do a better job of on-site user service than ERIC clearinghouses can, because they create separate files of much-requested materials not held in the ERIC system, such as catalogs and specimen curriculum units. As additional "local one-stop information centers" are opened, ERIC clearinghouses should reduce the ambiguity between their subject specialty and regional service roles by curtailing the latter sharply. In other words, the factories should stop selling their products one at a time.

Another kind of user service performed by clearinghouses is both appropriate and important. It is estimated that the ERIC clearinghouses answered more than 55,000 questions during the past year (1970). Experience at the Stanford ERIC clearinghouse indicates that 80 to 90 percent of these questions arrived by mail and were answered by mail. When a user corresponds with the ERIC system, it is our experience that he understands subject-matter distinctions

among clearinghouses and chooses the one that most probably holds the answer to his question. That is, the mail of each clearinghouse is genuinely national, not regional.

At present such correspondence service connects users with specialists at each clearinghouse. Occasionally a clearinghouse will serve as a switchboard to bring other clearinghouses or other subject specialists on the line. It is this latter capability of clearinghouses that should be expanded and systematized. As Figure 1 shows, the link between users and the clearinghouses is only one of three links that should be developed in the informal communication subsystem. Users should also be connected with knowledge producers and with other users, particularly those who are dealing with similar problems.

Almost every subject speciality is too large even for knowledge producers to know all their colleagues. The user is likely to know only a few names of knowledge producers who are active in an area that concerns him. He is even less likely to know other knowledge users dealing with similar problems in other regions, since their work receives less publicity than the work of knowledge producers.

The concept of a detailed directory of people to contact, organized around questions or problem areas that the people are competent to answer and/or are involved with operationally themselves, becomes more attractive with each advance in computer and quick-publishing technology. With such directories in the hands of users, and with clearinghouse backup in areas of ambiguity or rapid change, we would expect much more information flow directly from knowledge producer to user and from user to user.

Document files are an expedient alternative to direct communication between people who know and people who wish to know. If information centers could successfully switch inquiries and answers through direct rather than mediated channels, then much current emphasis on document storage and retrieval (especially of the more ephemeral literature of a field like education) could, with relief, be abandoned.

One-to-one communication is not the entire solution, however. If, for example, a researcher or developer has something of interest to communicate to every educational media specialist in the schools, it would be grossly inefficient for him to undertake a tour for the purpose of conversations across the country. Nor would one-to-one telephone or correspondence links be reasonable. At the same time, we can assume from the aggregate past experience of educational innovators that a document bearing the message would fail, for diverse reasons, to have impact in itself.

One-to-one direct communication errs in one direction; print communication errs in the other. The middle alternative is a system of group communication events organized solely around new additions to educational knowledge. Such symposia or workshops would differ from professional conventions in their focus on new knowledge, exhaustively surveyed, synthesized, and interpreted. (Studies of professional conventions show that they perform many important functions, but that systematic exposure to new knowledge is not well managed in them.)

There is a leftover archivist's mental set in the ERIC system that allocates funds to communication channels in inverse proportion

to their timeliness and interpersonal immediacy. It will be important for the future of the ERIC system that experiments in group communication be conducted in search of inexpensive, well-focused, information-rich arrangements. Early in the development of the ERIC system it was understood that archiving and formal communication processes don't "just happen " but have to be planned for, sometimes with infinite concern for the sequencing and integration of processes that impinge on each other. Now the mature ERIC system must give thought to a comparable "technology" of informal communication.