CSF

SYSTEMS DESIGN FOR EPIE

379 - 67

AUTHOR: D. HARRIS

COMMUNITY SYSTEMS FOUNDATION

COMMUNITY SYSTEMS FOUNDATION

1610 PONTIAC
ANN ARBOR, MICHIGAN 48105
313—761-1846

April 5, 1967

TO: Mr. P. Kenneth Komoski
Director
Educational Products Information Exchange
Institute For Educational Development
52 Vanderbilt Avenue
New York, N.Y.

FROM: Community Systems Foundation

SUBJECT: A Proposed Systems Design For EPIE

At your request, we have prepared a proposal presenting a recommended systems design for EPIE. Included is a general description of an ideal and operational system; detailed specifications and design recommendations for an operational system; a statement of implementation requirements, responsibilities, and costs; and estimates of the annual operating cost for the initial system.

We wish to acknowledge the cooperation and assistance received from other EPIE consultants too numerous to mention. The information which they contributed has been instrumental in the preparation of this report. We wish to especially thank Dr. Frederick L. Goodman, Associate Professor, School of Education, University of Michigan, for his constant guidance and assistance throughout this endeavor.

Respectfully submitted,

David H. Harris

David H. Harris
Managing Director

DH/kh

A SYSTEMS DESIGN FOR EPIE

THE IDEAL SYSTEM

Goals and Characteristics

In designing and implementing an information system, it becomes important to describe that system which displays upon examination ideal or perfect characteristics. In so doing, the creators of the system force themselves to state in precise terms the ultimate objectives or goals of their work. Never before has such a need existed more than it does for the EPIE system. Months of investigation and thought have led to the unavoidable conclusion that EPIE must be created with the joint recognition that it cannot at the outset fulfill all of its goals, yet it must continually progress closer to them.

For many reasons, EPIE cannot at once be an operational and ideal information system. Implicit in an ideal system are at least the following characteristics:

1. Users of the system would have the ability to gain access to information which would always influence the attainment of a " correct" decision.
2. Users of the system would have the ability to achieve instantaneous access to information in the system as frequently as desired.
3. The processing of requests for information would be fully automated in order to permit from the viewpoint of multiple simultaneous users full and instantaneous access to information.
4. The system would continuously experience full utilization of its resources, including personnel, plant, and information.
5. The cost of operating and maintaining the system would be zero.

Achieving the Ideal

Underlying the ideal characteristics above are a number of sub-goals which would have to be met and yet cannot be at the outset.

Implicit in the characteristic of always providing "correct" information are a number of characteristics which do not exist today and cannot be created within the time constraints established for the initiation of an operational system. Objective measures agreed upon by all would have to be available to determine the "correctness" of each decision arrived at by users of the EPIE system. Should a decision be judged correct on the basis of student performance using the chosen materials? On the basis of teacher's acceptance of the chosen materials? On the basis of whether or not the system user continues to use the EPIE system after a personal evaluation of the effectiveness of past use? Should it be judged correct on the basis of one, all, or a combination of these tests? Is one test more important than another? If so, how should each be weighed relative to the others? Within a test, how should terms such as "performance" and "acceptance" be scaled? Further, is student performance computed on the basis of percentile scores on standardized tests administered at the completion of a course in which the chosen materials were used, on the basis of the stature achieved in adulthood by the student in the study area, or by some other measure? How can the contributions to student performance made by the selected materials be isolated from those deriving from other materials, or from the teacher's role, or from exposure to other students?

Clearly, one could continue to ask such questions, with each serving to reinforce the dilemma of determining the "correctness" of a decision. Yet in an ideal system, the answers to all such questions would be known and the meaning of "correctness" would be abundantly clear and universally accepted.

Operationally, the EPIE system can go a long way towards the isolation of those factors which appear to account for judgments as to the correctness of

decisions. More precisely, statistical techniques exist for explaining the variance in judgments as to the correctness of a decision or the utility of a material. However, the successful use of these techniques does not rest on the ability of EPIE to attract skilled statisticians who can perform meaningful analyses of variance. Rather it rests on the ability of educators to 1) identify the factors or variables which do in fact cause the judgments of one person to vary from another and which cause the performance of one student to vary from another, 2) define these variables in operational terms which are understood and accepted by all who must use them, 3) design techniques for measuring and scaling the variables which are easily applied, acceptable to those performing the measurement and scaling, and valid with respect to possessing the sensitivity essential to achieve the explanation of variance which is inherent in the variable being measured.

Months of work by leading educators in the fields of curriculum analysis and performance measurement have shown that the above capabilities do not exist today. Progress has only just begun to be achieved in the above activities. Without these capabilities, the skills of the statistician in performing analyses of variance, the results of which would be used to synthesize data in the preparation of information for use by EPIE users-decision makers, would be so much folly. Clearly, EPIE cannot gain by performing and encouraging the use of results deriving from statistically sophisticated analyses on qualitatively infantile data derived from the use of measurement techniques whose reliability and validity is not only unproven but untested.

To achieve the second ideal characteristic above -- instantaneous, unlimited access to information within EPIE -- several requirements would have to be met which either exceed the resources likely to be available in the near future or which cannot be achieved prior to the gaining of experience via actual operation of the system. Implicit in the ability of the system user to achieve

access to information whenever desired are the requirements discussed above under the first ideal characteristic, plus the corollary characteristic of EPIE possessing the pre-requisite resources for fulfilling user demands. Fundamental to possessing such capability within EPIE is the possession of full knowledge of the demands which will be imposed upon the EPIE system, sufficiently early to permit the planning and acquisition of resources. Such knowledge would consist of demand sources, frequency of inquiry, processing time requirements (workload), user response time requirements, user location, user requirements for information display, etc. At the very least, EPIE would have to know in advance how many users it can expect, how many inquiries it will receive from each user, when it will receive these inquiries, how long it has to process an inquiry before the user considers service to be non-instantaneous, how much work is created by each inquiry, and so forth in order to intelligently investigate alternative methods of processing work and to plan and acquire the necessary personnel, equipment, supplies, housing, forms, etc. which collectively will comprise its resources.

Although survey techniques exist for forecasting demand and although EPIE has gained some knowledge as to potential sources of demand by defining a geographic pilot region, little can be done to forecast demand in the precise terms required for ideal planning and resource acquisition, as no system such as EPIE has been created which is sufficiently analogous to be useful in precision planning. Thus, an operational EPIE must forego the capability of meeting all potential demand instantaneously. Rather, it will sacrifice servicing a portion of the demand it might receive, or not possess the capability of instantaneous, on-demand service, or both.

Even if EPIE could forecast total demand in the terms required, this would not be enough to achieve the ideal characteristics of instantaneous, unlimited access to information. For to achieve such access to information which

will always lead to a correct decision, fully automated processing is prerequisite. The fulfillment of the first ideal characteristic will ultimately create a massive amount of information requiring repetitive processing in view of specific inquiries. A highly sophisticated information system of the type envisioned will require large amounts of data to achieve acceptable statistical significance in its analyses of variance. Further, it would not be feasible to perform analyses of variance on all possible combination of variables and material in advance so as to statistically pre-determine the potential appropriateness of a particular educational product in a particular environment. Rather, the ideal system will have to be designed to permit, when needed, the performance of such analyses. This will require the storage of large amounts of data in a form amenable to rapid search, retrieval, and manipulation, and the pre-programming of routines or rules for processing the data. Such tasks are ideally performed with the use of high-speed electronic computers, as they represent the most economical and reliable means for repetitive manipulation of large amounts of data in "random" or unpredictable combinations.

Another major reason for full automation is the characteristic of the ideal system permitting <u>any</u> user to achieve instantaneous access to information as needed. Under such conditions, the system must anticipate the presence of multiple inquiries which simultaneously require the use of one or several sets of data. Under a manual or partially automated system, this requirement could only be met by duplicating records of data in sufficient quantity to avoid the unacceptable delay of one user while another's inquiry is being processed. However, through the use of todays high speed, "time sharing" computer systems, the need to maintain duplicate sets of data for inquiry processing can be eliminated. Such systems permit many users to simultaneously share one set of data with the effective appearance of exclusive use.

However, the initial operational EPIE system cannot hope to include such

capability. For even if the "ultimate" data, analytical techniques, measurement techniques, etc. were available and ready, EPIE could not hope to have such a system operational by the Fall of 1967, as the computer programming requirements could not be met in the available time. Further, the acquisition of the necessary computer hardware, including communication devices for use in receiving, processing, and returning the results of system user inquiries could not be achieved in this time span. Also, the training of users in how to interface with such a system is a large task requiring the preparation of detailed instructional materials and considerable training time.

Thus, operational EPIE for a number of reasons cannot possess the characteristic of full (integrated) automation. However, this must be a major goal of the system if the other goals of sophisticated, reliable information synthesis (personalization) and as-need service to users (timeliness) are to be realized. The challenge to EPIE will be to transcend from a state permitting the servicing of inquiries over several days, weeks, or even months to a state wherein curriculum committees and others can utilize the EPIE system "live" as they perform the tasks of educational product evaluation and selection.

Finally, the ideal system characteristics of full resource utilization and zero cost cannot be met in an operational EPIE, no matter how sophisticated the system becomes. Yet these ideal characteristics should represent goals whose achievement is constantly being sought. Full utilization of existing resources should represent a guiding principle of never acquiring resources which are idle to a substantial degree. In particular, computers and staff should not be acquired until there is a reasonable probability that they will be utilized. Zero cost, in turn, should stand for the principle of cost minimization through effective organization, planning, scheduling, methods selection and supervision.

THE OPERATIONAL SYSTEM

Introduction and Goals

With the recognition that EPIE cannot achieve ideal status at the outset, yet can be of service to educational decision makers in the selection of materials if it becomes operational at a less than ideal level, the task at hand is to design a meaningful operational system in the face of the constraints which prohibit achieving the ideal. With the foregoing discussion in mind, the use of the term "operational system" is intended to represent a particular system which at once provides limited but useable information and service, which possesses the test of economic justification and survival, which recognizes in highly specific terms how it falls short of the ideal system, and which constantly strives to achieve the ideal through research, introspection, revision and sound management.

Unquestionably, there exist as many operational systems as there are individuals or groups to design such systems. With the recognition of the necessity of designing a less than ideal system, opportunity is created to design a number of systems which cannot be measured or justified in the precise terms of the ideal. Thus, it is difficult to evaluate the superiority of one "sub-optimal" design over another. As such, the operational system to be proposed in this paper is not intended to represent the one and only operational system, but rather a system which the designers feel will adequately conform to the definition above.

Perhaps the need for creating an operational system should be stressed. From the viewpoint of those members of the education profession who have seen in EPIE a means of vastly improving the decision making process of educational materials selection, an overriding need exists now to create an operational EPIE which will be justified as long as it provides the decision makers with better information than they now possess. To this extent, an annotated bib-

liography of all available materials in a particular curriculum area would represent an improvement.

However, if the system was comprised solely of the resources necessary to prepare and maintain an annotated bibliography, it would not meet the definition of an operational system as set forth, for it would not include the resources essential to carrying it closer to the goals of the ideal system.

Those who have supported EPIE are as much committed to an initial system which has the resources to continually evaluate and upgrade itself as it has resources to serve users on a current basis. To this extent, the initial system --called PILOT EPIE -- will be one part service and one part research. That part which is service will in some ways be less important initially than the part which is research, for it will be created within fairly severe constraints of limited time, money, and knowledge. In the process, it will sacrifice the achievement of many of the characteristics of the ideal system, for its overriding goal will be a pragmatic one of achieving some form of useful service within a short period of time.

Because, the orientation of the various consultants and advisors to EPIE varies with regard to discipline, experience, working environment, and interests, no uniform opinion exists as to what should or should not be included in PILOT EPIE from a service viewpoint. Some feel a strong need to provide initially information pertaining to the content of educational materials as well as their physical characteristics and the environments in which they have been used in the past. Others feel that concern over content will prohibit creating a PILOT EPIE in the near future which provides useful information. Still others see a major need to execute some semblance of statistical analysis in order to synthesize diverse information on a product, while others either intuitively believe variance is ultimately unexplainable by such techniques or that this element of activity is not essential to providing useful information in the early

stages of EPIE. However, as the consultants come to realize that PILOT EPIE is an experimental system designed to be of some service, but also designed such that mechanisms for evaluation exist which will permit intelligent retrospective analysis of the initial design and subsequent modification, they will readily see that the initial decisions of what will or will not be included in PILOT EPIE are acceptable regardless of whose bias is met. As long as the decisions taken lead to an on-going system, the valid interests of all concerned will eventually be incorporated.

GENERAL CHARACTERISTICS OF PILOT EPIE -- A SERVICE

Introduction

From the foregoing discussion plus an exposure over many months to the various individuals concerned with creating a PILOT EPIE, several major characteristics of the service aspect of PILOT EPIE emerge which appear to be fundamental to any initial system. These characteristics and some of the as-yet unsolved design issues subsumed in them will be presented here. It is these characteristics which form the basis of the detailed design proposed in a later section.

Standardized vs. Customized EPIE

First, PILOT EPIE must be capable of providing two classes of information. One must be "standardized" in the sense of being of interest and value to many users of the EPIE system. The other must be "customized" in the sense of being particularly relevant to a specific system user. Of necessity, the former type will be more general than the latter, for EPIE will not develop the standardized information to serve one particular sub-set of system users.

As a trivial but graphic example, standardized EPIE, in reporting on the physical characteristics of overhead projectors, would list projectors with switch panels on the right-hand side of the projector as well as those with

switches on the left. It would do so because 1) it must anticipate standardized system users who are both right-handed and left-handed, 2) it will not have received information from each standardized system user as to whether he is right-handed or left-handed, and 3) it will not have learned that each system user will only consider for purchase projectors with switch panels on one side or the other. In contrast, customized EPIE, in seeking to provide information on overhead projectors to a specific inquirer, can learn in the processing of the inquiry if the decision maker is interested in considering only those projectors with switch panels on one side or the other. Although EPIE's job is not to recommend right-handed or left-handed projectors, its job is to provide to the greatest extent possible highly personalized, useful information. As such, if an inquirer made it clear that he would not consider for purchase left-handed projectors, it would be pointless to provide him with names, specifications, performance reports, producer descriptions, laboratory evaluations, etc. of projectors with left-side switch panels. In other words, whereas standardized EPIE will provide information on a full set of products, customized EPIE will usually provide information on a sub-set of the full set.

Dialogue

For customized EPIE to provide such highly customized, exception-oriented information, it must of necessity know more about its users than must standardized EPIE. To gain this information, it will be necessary to engage in a dialogue with the users of customized EPIE in order to ascertain important variables to be considered in synthesizing information for feedback to the inquirer. However, no conclusive agreement has been reached on just what variables must be ascertained or what techniques should be used to do so. Some feel that highly structured, catch-all questionnaires and check lists should be used. The advocates of this technique place little confidence in the ability of the inquirer to define on his own volition those variables which are important to him and

feel as such he must be forcefully guided in his statements of relevant information. Others feel the inquirer should be permitted to state in his own terms and on his own volition the information (variables) of importance. The advocates of this technique fear that a highly structured information collection format has the inherent weaknesses of containing irrelevant questions and not insuring the retrieval of all relevant information. Still another "school" supports a combination or blending of these two techniques.

As to how these techniques should be invoked, some feel that written questionnaires and check lists can be made to be self-explanatory or accompanied by written instructions and thus sent and retrieved through the mail without direct, personal contact. Others feel some degree of direct contact is required to retrieve information from the inquirer and, therefore, advocate the use of telephones. Still others fear that certain important elements of the educational environment surrounding the inquirer will not be recorded if field visits (on-site) are not made in the process of gathering information, and thus advocate this approach. Still others advocate combinations of the above.

At this point, the complexity of designing even a simplified operational system becomes evident. It is precisely this type of "option scheme" which must be met face-to-face, with a decision being made and an evaluation plan developed. In a later section, this issue will receive further attention and recommendations will be offered. At this point, the item of importance is that in one or more ways, PILOT EPIE must possess the capability of retrieving detailed information from and about users of the customized service in order to provide customized information.

Limited Instructional Materials

Next, it is agreed that PILOT EPIE must begin with a limited number of instructional materials rather than provide information on all instructional materials. This agreement has of late been made more specific by the selection

of one curriculum class -- Elementary Science --, one information transmission product class -- overhead projectors --, and one information storage product class -- overhead projectuals -- for inclusion in PILOT EPIE. As to what information should be contained in EPIE with respect to these classes of materials, agreement has not been reached on specific items of interest. However, there appears to be, in general, concern with the information content, application environment, and physical characteristics of Elementary Science materials; with the physical characteristics and application environment of overhead projectors; and with the physical characteristics of sets of projectuals (e.g. a transparency series vs. an individual transparency in the series).

Active vs. Passive Information

Below this surface of agreement, however, is division as to the specific information about each material class which should be included. In each of the above areas, the consultants are working to define the variables of importance or inclusion. It is in general agreed that PILOT EPIE will initially permit a limited number of variables to be actively used in the performance of information synthesis, while others will play a more "passive" role in that they will be utilized for data collection and research, but not for information synthesis. It is also agreed that the system should in some sense permit the user to declare those variables which are active and to weigh variables relative to each other in terms of importance. Since, however, the information search and synthesis heuristics are not defined at this point in time, it is not yet clear that a strong need exists to actually utilize knowledge of user variable preferences and weights.

Information Sources

It is further agreed that information in PILOT EPIE should be a compendium of knowledge obtained from three key sources -- producers, past users, and independent analysts or researchers. Inherent in this approach is the goal of

providing the inquirer with information developed by people of different perspectives, capabilities, motivations, and experiences. Further, there exists the belief that EPIE must not appear to represent a biased source of information, which it would if it appeared to favor one or two of these three legitimate sources of information. However, efforts to date have not produced knowledge as to the mix of information from these resources which is available today. That is, although the goal of balance exists, determination of the requirements to develop reports by these three suppliers of information in view of existing documentation and its usefulness has not been carried out.

Limitation of System Usage

Just as it is agreed that the information in the system initially will be limited to specific classes of materials, so, too, is it agreed that the use of the customized portion of EPIE will be limited at the outset. Steps to define this limited use taken so far have been 1) the decision to restrict inquirers to participating (paid) members who directly exercise or influence the decision-making process of evaluating and selecting materials, (excludes producers) and 2) the decision to restrict inquirers to individuals or groups meeting the above criterion whose school systems are within the geographic boundaries identified by those of the ERIE and RBS regional educational laboratories (Delaware, New Jersey, New York, Pennsylvania).

However, the planning of resources to service users cannot be effectively made without more explicit knowledge as to the demand on the system. Within the bounds of the user set currently defined, more explicit definition will have to be reached which seeks to protect the economic solvency of EPIE and the desire of school systems within the four states to utilize customized EPIE. In particular, plans must be based upon projected numbers and locations of users, user types, frequency of inquiry per user, response time requirements, service time requirements, etc.

Once these projections are made and resources acquired in proportion, the resources will represent limitations on the ability of PILOT EPIE to service customized demand in the short run, for the nature of the resources (e.g. - personnel, equipment) will limit the ability of EPIE to respond to unanticipated demand volumes in the short run. No such constraint will exist for standardized EPIE, for varying demand (within reasonable limits) can be met by varying the number of copies printed of the publications which will represent standardized EPIE.

Other Material Limiting Mechanisms

Other mechanisms for limiting the scope of customized EPIE have been identified. Within the curriculum area of Elementary Science, material included will be limited to products produced by major publishers and manufacturers with reasonably wide distribution channels. In particular, highly specialized publications of limited distribution but of a pedagogical nature will not be included initially. Further, pedagogical material created by private individuals rather than publishers (e.g. - teachers, curriculum committees) and non-pedagogical material useful for that purpose (e.g. - magazine articles) will not be included. This decision has been reached in the face of the non-existence of any efficient mechanism for retrieving and updating information on instructional materials other than those which are widely known, widely available, and created for pedagogical purposes. At the outset, customized EPIE will rely heavily on such sources as the McGraw-Hill Producers Input Guide for identifying the existence of educational products within the selected areas.

Limitations on Product Information

Another constraint to be created is the establishment of policies which limit customized EPIE's ability or willingness to provide information on products within the selected areas. Several such policies have been formulated at a general level and are presented here.

Minimum Information Unit

First, the smallest product information unit within customized EPIE will be a purchaseable item. For example, if the materials within a series can only be purchased by buying the entire series, product information will be retrieved for the series as a whole rather than for selected components. This is not meant to imply that information about various components of the series will not be available from producer's profiles, user reports, etc., but rather that the information retrieval system will be geared towards retrieving all information on a purchaseable product provided by a particular source rather than only a portion of the information provided by that source. Further, the providers of information will be expected to relate their evaluations and reports to the total purchaseable item.

Minimum Number of Reports

Second, customized EPIE will establish "lower thresholds" on the number of reports from a particular source type on a particular product which must be available before synthesized information on the product will be provided, information which draws from reports submitted by the given source type. For example, synthesized information which draws upon reports submitted by past users of a particular product will not be used unless a specified minimum number of reports on the product have been received from past users. This policy is particularly necessary given customized EPIE's limited initial ability to carry out statistical analyses of comparative information in which the effects or limitations of sample size would "automatically" be accounted for.

Nor will this policy restrict EPIE from providing information on products for which a sufficient number of reports exist from one or more source types. For example, if the lower threshold on reports from information analysis specialists (i.e. - logical analysts) has been met, but that for past users' reports has not, the information from the analysts would be used in processing

the inquiry, but that from the past users would not. As a sufficient number of additional past user reports are acquired to overcome the lower threshold, the total supply of past user reports would be "activated" for inquiry processing. In this way, the inquirer is protected from receiving synthesized information which is unsupported by a reasonable amount of detailed information, while at the same time EPIE is not restricted from processing inquiries until sufficient information is available from all three of the major source types.

Minimum Potential Expenditure

Third, customized EPIE will seek to achieve economical utilization of its limited initial resources by requiring a minimum potential expenditure to be associated with an inquiry before the inquiry will be processed. This will be achieved by establishing a formula which takes into account the unit cost of the product (or a "typical" unit cost in the case of multiple items within a product type), the quantity being considered for purchase, and the source of the inquiry (e.g. - a county school district vs. an individual school). The latter factor is intended to represent the probable extent to which the purchase would utilize the total educational products budget of the education unit represented by the inquirer. The formula will be created with the goal of avoiding the use of EPIE's initial resources in processing inquiries which represent a very small percentage of the products budget under the control or influence of the inquirer. Thus, whereas a teacher may be permitted to submit an inquiry relating to a potential expenditure of $25, a superintendent of a county school district may have the same inquiry rejected. This policy is analogous to advising a large business not to hire a management consultant in order to save $100 by solving an operating problem. However, it also recognizes that there are different sizes of businesses, and that saving $100 may be extremely worthwhile for some of the smaller ones. Since there will always be a cost associated with the use of customized EPIE's time and resources, and since the time and resources required

to process an inquiry will not be directly proportional to the amount of potential product expenditure underlying the inquiry, this policy is necessary for the maintainance of a reasonable charging structure.

General Information Content Retrieval

Fourth, customized EPIE will initially operate under a policy of general rather than highly specific retrieval on the information content of a product. For example, a general science text may contain a chapter which discusses the science of meteorology. Within the chapter, alternative methods of forecasting the weather may be presented, with one such method being probabilistic forecasting. Customized EPIE will not index the contents at the "alternative forecasting methods" level, but rather at the "meteorology" level. As in an earlier example, this doesn't mean that one or more reports from past users of the text may not have commented on or evaluated the treatment of probabilistic weather forecasting. What is implied is that the normal search and retrieval methods of customized EPIE will not permit selective searching for science texts dealing with probabilistic weather forecasting.

Rather, the normal procedures may lead to the retrieval of the names of a number of texts which discuss the science of meteorology. A policy will then have to be established to determine whether at that point additional EPIE staff time is expended to "hand search" (i.e. - scan) the selected texts to determine if one or more discuss probabilistic weather forecasting or whether this task should be left to the inquirer. To date, no such policy has been formulated.

Since past user reports will be available on the selected texts, the possibility still exists that a review of these reports will produce information on a particular text's treatment of probabilistic weather forecasting, if the evaluator chose to highlight that portion of the content. At this point, however, such detailed information retrieval becomes coincidental rather than planned.

If additional EPIE staff time is expended on "hand searching", the policy will also have to determine whether additional user charges are to be assessed, either in the form of monetary charges or time charges to be applied against the users "account balance" of available time.

The establishment of such policies are design details which will require further development by those responsible for implementing PILOT EPIE. At this point, the concepts behind the policies are presented to indicate the level where design decisions have been made and those where they have not.

Flexible Information Retrieval

Another policy decision which has been reached is the decision to design a highly flexible information retrieval system. The system must be flexible in the sense that it must be capable of efficiently handling via normal retrieval procedures diverse inquiries of significant frequency. For example, EPIE anticipates receiving frequent inquiries on the use of Elementary Science kits, without reference to specific ones. It must, therefore, have a retrieval system which permits the consideration of all kits, in the sense that the search and selection process must begin with the "universe" of information on available kits within the EPIE system. Conversely, EPIE also anticipates the receipt of inquiries relating to a specific type of kit (e.g. - a botany kit), or even a particular manufacturer's kit. As such, it must also be able to cull from the information file only that information which pertains to the particular "subset" of the kit "universe" of interest.

Further, just as EPIE must be able to "slice the information pie" by product, so, too, it must be able to do so by curriculum and by information source (i.e. - producers, past users, researchers). To achieve this flexibility -- regardless of the use of automated equipment -- will require the careful design of indexing procedures and coding schemes which would challenge the

imagination of even the most experienced designers of information retrieval systems. The detailed design of indexing producers and coding schemes is outside the scope of the present design activity and will require substantial and continuing effort. However, some guidelines for the designers will be recommended in the next section.

No Product Samples

The second policy is the decision not to provide users with "hard copies" of products in which they are interested or which are represented in an inquiry response. It is felt that many problems would arise if such service were attempted, not the least of which is the high cost to EPIE of procuring samples of the thousands of products included in the system. (As an independent, unbiased information service, EPIE would threaten the credibility of its position if it were to acquire product samples by any method other than purchase).

Adaptive Information Retrieval

In addition to designing an information retrieval or indexing system which is flexible in the sense described above, the system must also be adaptive in two ways. First, recalling the earlier discussion of active vs. passive information, an efficient system will employ different techniques for classifying and handling these two types of information. Information considered passive will be encoded in limited ways, whereas active information will be highly encoded. Also, normal search procedures of active information may entail some use of electronic data handling equipment, such as sorters and collators, and manually operated coordinate indexing systems (e.g. - Peek-A-Boo system), whereas passive information search procedures may be constrained by standard classification indexing systems designed to organize written material stored in filing cabinets.

The design, however, must be prepared to respond to experience in using