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ABSTRACT

The first two papers in this collection introduce both the Research and Development Exchange (RDx) itself and the subsequent contracted papers in this and a companion volume. The first paper discusses the general problems toward which the RDx effort is directed, understandings and assumptions affecting the design of the work, principles guiding the work, goals and objectives, and current activities. The contracted papers were expected to address such questions as the following: What do experiment and the diffusion of innovation literature teach participants in the RDx system? What strategy should be developed for implementing the RDx system? What are the interorganizational conflicts, barriers, and opportunities that are likely to affect system development? How can research products best be transformed into products that are usable to clients, practitioners, administrators, and policy-makers? What models of linkage and research utilization should be employed in this system? What do literature and practice in the areas of marketing have to offer to RDx participants? What methods of monitoring and evaluation should be built into the development of this system? Each of the papers to some extent addresses the themes of educational research, the regional context, interorganizational relations and management, and staging and phasing. (Author/IRT)

CENTER FOR THE
INTERDISCIPLINARY STUDY
OF SCIENCE AND TECHNOLOGY

Northwestern University
Evanston, Illinois

Information Dissemination And Exchange for Educational Innovation

Conceptual And Implementation Issues Of A Regionally-Based Nationwide System

December 1977

Edited by:
Michael Radnor
Durward Heller
Robert Rich

PART ONE

INFORMATION DISSEMINATION AND EXCHANGE FOR EDUCATIONAL INNOVATIONS:

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The project reported herein was performed under Contract #NIE-C-400-76-0110 for the National Institute of Education, Department of Health, Education and Welfare. However, the opinions expressed herein do not necessarily reflect the position or policy of the National Institute of Education and no official endorsement of the National Institute of Education should be inferred.

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Part 1

CHAPTER ONE

THE R&D EXCHANGE: AN EMERGING EFFORT

AUGUST, 1977

Susan Klein

Richard McCann

Mary Saily

(Although written by the authors listed above, this paper reflects the contribution of many RDx participants and advisors. This August, 1977 version was made available to the authors of this two volume report. The most recent version of "The R&D Exchange: An Emerging Effort" at the time of printing this report has been included as Chapter 10 in Volume II. Additional copies or subsequent versions of this paper are available from the R&D Exchange--Suite 206, 1518 K. Street, N.W., Washington, D.C. 20005.)

This paper is a draft statement designed to further discussion about the Research and Development Exchange (RDx) among RDx contractors, the RDx Advisory Group members, and the National Institute of Education (NIE) staff. It will periodically be revised and refined based on discussion and experience.

The paper touches on a variety of topics of continuing concern: the general problems toward which the RDx effort is directed, understandings and assumptions affecting the design of the work, principles guiding the work, goals and objectives, and current activities.

THE PROBLEMS

In the 1960s the federal government began to increase significantly its funding of educational innovation and improvement and as part of this effort, its funding of educational research and development. In authorizing the National Institute of Education as the primary agency for the support of educational research and development, the Congress made clear its expectation that NIE should both support research and development which is responsive to needs of educational practitioners and carry out dissemination activities to insure that practitioners benefit from the results of educational research and development.

Because of its dual mission, NIE has these concerns: (1) to what extent are the outcomes of educational R&D being effectively disseminated -- that is, how are they affecting educational practice; and (2) to what extent is the R&D community responding to the needs and problems of educational practice?

With regard to the first concern, educational practice seems to be affected primarily in three ways be educational R&D: (1) selected classrooms, schools and school districts have been directly involved in specific educational R&D projects; (2) schools and school districts

have purchased materials which have resulted from R&D projects and which are now being published and actively marketed by a commercial firm; and (3) teachers and administrators have, through informal networks, learned about, adopted, and/or adapted concepts and practices that have resulted from R&D outcomes. Therefore, NIE decided that other ways to disseminate R&D outcomes should be explored.

With regard to the second concern, NIE recognized that there are many factors that influence the kinds of research and development work being done. These include the intellectual background of researchers, their experience with educational practice, the incentives provided by their professional colleagues and their institutions, and perhaps most importantly, the policies and procedures of R&D funding agencies. NIE questioned whether these factors are resulting in decisions to do R&D which is truly responsive to practitioner needs. Therefore NIE decided to explore new ways of identifying the R&D needs of educational practitioners and bringing their needs to the attention of R&D funding agencies and educational researchers and developers.

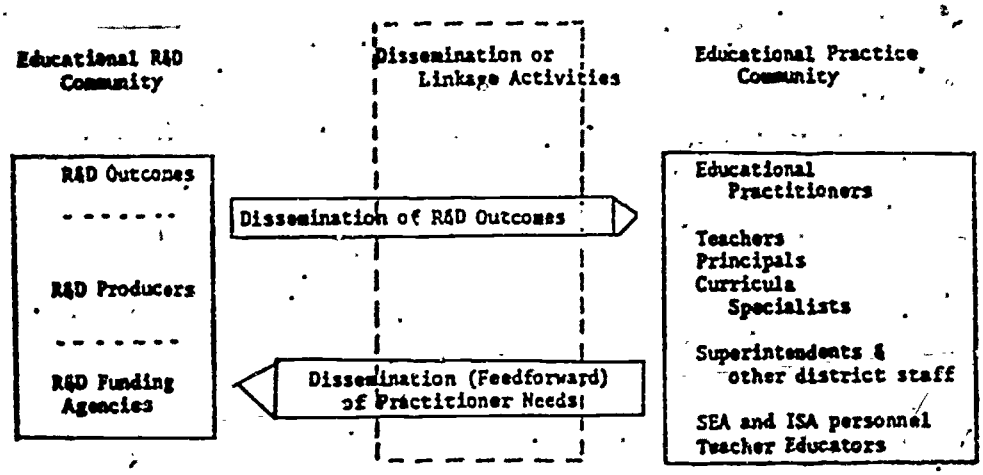
In order to initiate such explorations, the NIE Dissemination and Resources Group launched in the fall of 1976 a collaborative planning effort involving educational laboratories, R&D centers, state education agencies, intermediate agencies, and USOE regional offices. The purpose of the planning effort was to explore ways to bring educational R&D results to practitioners and to feedforward their needs and concerns to educational researchers and developers and their sponsors. This effort has come to be called the Research and Development Exchange (RDx).

DEVELOPING UNDERSTANDINGS AND SHARED ASSUMPTIONS

In the course of the planning effort, certain understandings have developed and some basic assumptions have emerged. These under-

standings and assumptions are defining the problems, determining the operating principles, and shaping the pilot activities that the RDx is undertaking. Figure 1 presents a framework for discussing some of these understandings. It also offers a means of delineating the three general problem areas on which the RDx is focusing.

FIGURE 1



On one side of the figure is the educational R&D community: the agencies which fund educational R&D, researchers and developers, and the outcomes of R&D. On the other side is the world of educational practice: those directly involved in the design and delivery of educational programs in the management and maintenance of educational institutions. NIE's two concerns are reflected by the two arrows: how best to disseminate R&D outcomes to educational practitioners and how to "feedforward" information about practitioner needs to researchers, developers, and R&D funding agencies. Involved with these concerns are a wide variety of developing dissemination organizations and individuals who are performing the "linking" function. These groups are indicated in the center portion of the figure.

Given this framework, the following three general problems emerge: (1) how can practitioners' understanding and use of R&D outcomes be increased; (2) how can R&D outcomes better reflect practitioner needs, concerns, and findings; and (3) how can the quality and efficiency of organizations and personnel involved in linking R&D outcomes with practitioner needs be improved? Our analysis of how the R&D Exchange can help respond to these problems is based on certain understandings and assumptions about the educational practitioner community, the educational R&D community, and the dissemination or linkage activities that are beginning to connect these two communities.

Educational Practice Community

Educational practice is a complex enterprise which encompasses 50 states, 17,000 school districts, and 106,000 schools and which involves millions of professionals and students. The practitioners of particular interest to the RDx are those teachers, principals, curriculum supervisors, district administrators, and state and intermediate education agency personnel who participate in determining the purposes of education, designing educational programs, and creating and maintaining the organizations that deliver those programs.

Practitioners are decentralized to many settings--each of which, whether classroom, school, district, or state department--operates with a sense of autonomy. Each setting, in part, represents distinct interests and needs. Thus we assume that the practitioner community is pluralistic in nature. Consequently, it is unlikely that one R&D outcome or set of outcomes will meet everyone's needs.

In addition, we assume that educational practitioners generally do not have sufficient time or resources to initiate major changes. Change in educational practice therefore tends to occur incrementally. For example, changes are regularly being made in instructional materials, in instructional method, in schedules, or in organizational arrangements.

However, these changes rarely occur at one time and in a comprehensive integrated way. Further, the new materials or processes are integrated with existing available resources and adapted to fit user constraints.

Educational R&D Community

The educational R&D community is also a complex enterprise. The R&D Exchange is primarily concerned with three aspects of this community: the R&D funding agencies, the R&D producers, and the R&D outcomes themselves.

R&D funding agencies. Though educational R&D work is funded by all levels of the educational system and by the private sector, the primary sponsor is the federal government (NIE, 1976). By the government's own analyses (NSF,OMB, USOE), seven major agencies with the Department of Health, Education, and Welfare fund educational R&D. In addition, nine agencies related to departments other than DHEW are also involved in funding some educational R&D. Considering the numbers of bureaus, divisions, branches, and programs found in this collection of agencies and the variety of legislation authorizing this work, it is reasonable to assume that the current funding of educational R&D is dispersed and is guided by a very diverse set of policies and procedures.

R&D producers. R&D producers are a subset of a broader community of individuals, groups and organizations which are involved in efforts to improve educational practice. In theory, what distinguishes R&D producers is their effort to understand educational practice, to build theories and conceptual models based on those understandings, to develop practices based on those theories and models, and to subject those theories, models, and practices to tests. R&D producers are found in many settings---in school systems, intermediate service agencies, state education agencies, federal agencies, universities and colleges, R&D centers and laboratories, and a variety of private corporations.

R&D outcomes. For this paper R&D outcomes are defined as those curriculums, products, skills, programs, instruments, teaching and management methods and techniques, concepts, and the like that are produced by disciplined inquiry involving activities normally considered part of the R&D process such as conceptualizing, hypothesizing, developing models, field testing, data gathering and analyzing, and evaluating. Evidence of effectiveness, judged according to professionally acceptable standards, is also a hallmark of R&D outcomes. Included in this definition are exemplary practices developed by local schools and shown to be effective and of high quality.

The RDx planning effort is concerned with the following related outcomes: (1) the findings of specific studies; (2) concepts as well as generalizations involving those concepts which structure current perception and summarize current understanding, (3) educational practices which operationalize current understanding in specific settings, and (4) products which help others adopt, adapt, and implement specific R&D based practices. These outcomes relate to one another in the following way: concepts and understandings guide the design of studies and the development of practices; the findings of studies modify current understanding; products are derived from developed practices; the use of products result in the spread of specific practices; wide practices provide settings for new studies. Therefore, when one talks of disseminating R&D outcomes, one is talking of disseminating a complex of outcomes which illuminate each other.

The RDx planning group has made several assumptions about R&D outcomes. First, we assume that R&D outcomes are not used as extensively as they could be. Evidence suggests that schools are less likely to use R&D outcomes than non-R&D outcomes. For example, in a recent survey of the 100 most frequently used instructional materials in elementary and secondary math, reading, science, and social science, only 15 were classified as R&D programs or products. (EPIE, 1976)

Second, we assume that practitioners are receptive to using externally developed R&D based outcomes. There are those who would argue that externally conceived and developed ideas and products will not or cannot be used by local schools. Such arguments assume that local requirements for "ownership" and incentives for change militate against the use of such outcomes. However, schools have a long tradition of buying and using commerical materials. In fact, teachers base approximately 95 percent of their total teaching time on the use of such materials whereas locally developed materials are used fewer than 5 days per school year. (Komoski, 1976)

Third, we assume that R&D outcomes are of sufficient merit to warrant their use although there is, of course, little persuasive evidence that existing R&D outcomes provide complete solutions to major educational problems. In fact, effectiveness data is not available for many R&D outcomes. For example, only 15 percent of over 700 products sponsored by NIE thus far claim to have evidence of effectiveness. However, this percentage is probably much higher than for non-R&D products. Furthermore, approximately 95 percent of these products have claimed the use of three R&D elements.* These elements are aimed at achieving or assessing effects. Thus information about the strengths and weaknesses of R&D outcomes--including their quality and usability--is higher than the 15 percent figure indicates. This type of information is often unavailable for non-R&D outcomes. Finally, mechanisms such as the Joint Dissemination Review Panel have been and are being developed to identify "effective" practices. The R&D Exchange is concerned with these types of R&D outcomes as well as NIE sponsored products.

Fourth, we assume that many R&D outcomes are currently unavailable even if consumers become aware of their existence. In fact, approximately 25 percent of the R&D outcomes produced by NIE are

* R&D elements include empirical support that a product is needed and/or is designed to meet the need; preparation of the product in a testable form; empirical testing of the product with users; revision of the product based on users' reactions; planning for dissemination; reviewing the product for content accuracy, social fairness, etc.

not available in a form consumers can readily use (for example, copies of instructional materials may only be available in microfiche). And only 44 percent of NIE's products are available from commercial publishers or the developers.

Fifth, we assume that even when R&D outcomes are available, many have not been disseminated efficiently. Responsibility for dissemination has frequently been undertaken by the developer, either directly (through a federal contract or other means) or through an arrangement with a commercial publisher. The goal has been to reach out to potential clients to try to secure adoption and use of the innovation. This strategy is costly and inefficient from the standpoint of the federal funding agency because it involves many developers reaching out to the same schools at the same time. Also, it is inefficient from the standpoint of the consumer who must cope with quantities of information from a variety of sources.

Finally, we assume that R&D outcomes could become more relevant to user needs. Information about practitioner needs has generally not been systematically solicited by R&D producers. Thus many R&D outcomes are not as relevant to user needs as they might be. Also, such information could change the character and content of R&D work and consequently result in different types of outcomes than might otherwise emerge.

Dissemination, or Linkage, Activities

We have described understandings and assumptions related to the two sides of Figure 1 -- the educational practice and the educational R&D outcomes and feedforward of practitioner needs, concerns, and findings.

Dissemination of R&D outcomes. At present there is no single, comprehensive system for disseminating R&D outcomes to educational practitioners and there appears to be a consensus that such a system would be undesirable. Instead, the 1977 Dissemination Forum, attended by individuals from all levels of the educational community,

called for the development of a "nationwide dissemination configuration." Some R&D resource elements of this configuration have already been developed:

> Education Resources Information Center (ERIC) indexes and stores articles and reports of research conducted, understandings developed, and practices tried.
>
> The Joint Dissemination Review Panel has identified "effective" practices developed through federal monies and the National Diffusion Network is helping practitioners consider their practices for adoption and implementation. Some state education agencies are developing similar review and diffusion systems.
>
> State education agencies, intermediate service agencies, some universities, and large school systems are developing resource centers and staff capability to help practitioners define their information needs, to do information searches for practitioners, and to help practitioners to use the information obtained.
>
> Special projects (e.g.: NIE's R&D utilization projects) are exploring procedures for helping practitioners with specific problems (student performance in the areas of basic skills or career preparation) to consider and use R&D outcomes to solve or at least ameliorate their problems.

Thus the resource element of the developing nationwide dissemination configuration includes multiple functions and actors. As such it reflects the pluralistic nature of the educational community it serves. The RDx planning group has assumed that because of this pluralism a variety of dissemination efforts are needed to link practitioners with appropriate R&D outcomes. By the same token, a variety of alternative R&D outcomes should be made available to meet differing needs. We assume, therefore, that a more rational and informed approach to dissemination and adoption of R&D outcomes is in order. A "rational" strategy would include careful identification of needs and potential options for meeting those needs; careful selection of the most appropriate R&D options for each situation; and help in using and adapting the selected options.

We assume, further, that R&D producers, disseminators, and practitioners generally lack the information, resources, skills, and time to carry out dissemination activities in a planned, consumer-oriented way. As stated previously, dissemination has frequently been carried out by developers on a client-by-client and product-by-product basis (i.e., product advocacy). Consequently, practitioners have often been unaware of the vast array of available educational R&D outcomes. Also, users have not generally been exposed to objective, comparative, analytical information about educational outcomes on which to base rational selection decisions. Instead, the school decisionmaker has been subject to the serendipitous effects of which salesperson arrives at the office door first. And it has been difficult for these individuals to compare or judge the validity of information presented by different salespersons due to time constraints and the type of information presented.

Thus the RDx assumes that dissemination of alternative R&D outcomes (choice), rather than dissemination of information about single products (product advocacy), is needed to meet the needs of the diverse educational community. Further, better interpretive information is needed regarding R&D outcomes and skilled disseminators, or linkers, at all levels of the educational enterprise are needed to help users obtain such information and select and use appropriate alternatives.

Feedforward of practitioner needs. The current method of feeding forward information about education practice to influence R&D funding agencies and producers is primarily political. It is made up of a network of interest groups—for example, the Council of Chief State School Officers, the government liaison offices of universities and colleges, professional associations and unions, and special purpose groups related to specific government programs like CEDaR, NDN, or the ERIC Clearinghouses. These groups regularly present their points of view directly to the staffs of federal agencies and to the Congress. In addition, they seek to have their points of view represented on agency advisory groups and proposal review groups. Thus, if there is a system for feeding forward information about educational practice which influences the work of educational researchers and developers, it is somehow embodied in the legislative mandates, agency policies and regulations, and requests for proposals of the federal government.

The R&D community, however, does provide some evidence of the interests and needs of educational practitioners primarily through surveys, evaluation studies, and policy analyses. This work tends to focus on targeted problem areas and typically has not attempted to assess the broad needs of education.

Thus dissemination, or feedforward, of practitioner needs has been similar to dissemination of R&D outcomes in character, if not in content--that is, both have been political, opportunistic, and serendipitous. The RDx assumes that a more rational, systematic strategy for feeding forward information about practitioner needs, concerns, and findings would result in higher quality, more responsive R&D outcomes. We recognize that a substantial amount of such information has already been collected through state assessments, regional laboratory efforts, and the like. Thus we assume that RDx efforts should build on existing data. Once again, skilled linkers are needed to help obtain and feedforward such information to R&D funding agencies and producers.

OPERATING PRINCIPLES

After arriving at common understanding and assumptions regarding the nature of the educational practitioner community, the education R&D community, and the dissemination process, the RDx planning group adopted certain operating principles to guide its developmental activities. These principles define both what the RDx is and what it is not. They are discussed below.

1. The RDx effort will be planned and conducted in a collaborative way. We have assumed that the educational community is pluralistic and decentralized. It follows that we will therefore involve representatives of practitioners, dissemination systems, and R&D producers and funding agencies in both the definition of problems and the design of activities to address those problems. The RDx will not be a new national dissemination system.
2. The RDx will propose activities complementary and supportive of other agencies. We have recognized that many R&D resource elements of a nationwide dissemination configuration already exist. We have assumed that the RDx will build on these existing activities and functions, not seek to replace them.

3. The RDx effort will be developmental. We have assumed that the needs of practitioners are diverse and changing. We have also assumed that the R&D community should be responsive to these needs. It follows, therefore, that the RDx contractors, together and separately, will not start with fixed notations of what the problems are and how they should be solved. Instead, we will work through cycles of analyzing the current situation, defining problems, designing possible solutions, testing solutions, and then reassessing the situation, the problem definition and the solution design.
4. The RDx will be a coordinated effort; that is, the contractors will work together to explore ways of organizing the work to insure optimum use of available resources. For example, we have assumed that practitioners need more and better information about R&D outcomes. Thus some tasks, such as knowledge synthesis, will be done on a centralized basis. However, we have also [illegible] that practitioners have diverse needs. Therefore [illegible] be carried out on a decentralized basis. The RDx contractors will work together to determine which arrangements best meet the criteria of effectiveness and efficiency. They will not act as nine separate, independent contractors.
5. The RDx will explore alternative strategies and solutions. We have assumed that the educational community is complex and diverse. Therefore the RDx will encourage the use of alternative dissemination, feedforward, and linkage strategies to accommodate different needs, problems, and situations. The contractors will also compare and contrast different strategies to determine their relative utility. Thus the RDx will not advocate individual strategies nor will it advocate particular R&D outcomes as solutions.
6. The RDx will deal with a variety of problem areas and a general clientele. We have assumed that practitioners in general need more and better information about practitioner needs. Therefore the activities of the RDx will be general rather than specialized in nature. However, because of funding and other resource

constraints the RDx will initially concentrate its core efforts on the priority areas of basic skills (math and reading/language arts) and competency-based education.

7. The RDx will use a linkage/brokerage strategy. We have assumed that a variety of organizations and individuals are already involved in dissemination activities. Not only will RDx operate in a complementary fashion with these existing disseminators but we will attempt to work with and through them to carry out dissemination and feedforward activities. That is, the RDx will by-in-large attempt to link local practitioners with R&D resources rather than provide direct service.
8. The RDx will depend on NIE for core financial support but will encourage others to share the support burden. While NIE plans to provide substantial continuing support, the RDx will be expected to sell or barter some of its services.
9. The RDx will work to ensure equity. The contractors will provide for full employment opportunities for women and minorities and will promote social fairness toward minorities, women, and other protected classes in all RDx activities.

WHAT DOES RDx HOPE TO ACCOMPLISH?

Based on our understanding of the three underlying problems and our assumptions about the current educational environment as well as our future expectations, we believe that RDx should adhere to its operational principles in pursuing the following goals and objectives:

Goal 1--Increase linkers and subsequently practitioners understanding and use of R&D outcomes by:

- 1.1. Increasing the availability of linker/practitioner oriented information about the relative merits and characteristics of R&D outcomes.
- 1.2. Making high quality R&D outcomes more accessible to practitioners.
- 1.3. Helping practitioners use a mix of R&D outcomes efficiently and appropriately.

These objectives are primarily concerned with the flow from the R&D community to the practice community.

Goal 2--Improve the quality and utility of the R&D outcomes for practitioners by:

2.1. Increasing the availability of information about practitioners needs and current activities to help the R&D community make decisions about the production and delivery of R&D outcomes.

2.2. Increasing the availability of information about exemplary locally developed practices which the R&D community may help define, package and deliver to practitioners.

2.3. Increasing the availability of information on R&D outcomes and their use to share with linkers (to help them address 1.1) and the R&D community to guide revisions and future R&D work.

2.4. Helping the R&D community obtain and use the above information.

These objectives are concerned primarily with the flow from the practitioner community to the R&D community.

Goal 3--Improve the quality and efficiency of organizations, activities and personnel who are trying to link R&D outcomes with practitioner needs by:

3.1. Increasing the understanding of current dissemination activities, needs and problems.

3.2. Providing brokerage or referral services to help linkers, and subsequently R&D producers and practitioners, identify and use dissemination resources more effectively.

3.3. Providing direct services to help linkers acquire information, tools and skills to help practitioners identify and use R&D outcomes which are most appropriate to their needs.

3.4. Providing direct services to help linkers or linkage organizations plan and improve their operations and their dissemination capabilities.

These objectives are concerned with the central portion of Figure 1. That is, they are concerned with improving the linkage or dissemination functions of individuals and organizations whose primary responsibility is to facilitate a two-way flow between the R&D and practice communities. Such individuals may also act as liaisons within the dissemination community. They may, of course, be employed by either the R&D or the practice community. For example, such a person could be a marketer for a publishing firm or "internal linker" for a school district.

To show how the three goals and accompanying objectives are being addressed by the nine current RDx contractors, we have prepared a chart of sample ongoing and future RDx activities. The chart follows this section. The structure of the RDx is then described in Figure 2.

SAMPLE RDx ACTIVITIES TO ACCOMPLISH THE OBJECTIVES

Objective	Activities To Date	RDx Contractor(s)	Future Activity
1.1 Increased Linker/ Practitioner information about r&d outcomes	Identify materials and information systems which provide information on alternative educational programs and products.	RDIS RAS	Determine value of a select group of those products to practitioners
	Develop model products which pull together r&d information on r&d and product alternatives in RDx priority areas.	RDIS SSC	Identify and develop additional r&d interpretation products.
	Design an experimental strategy and alternative formats for delivering information to two categories of users in the area of mathematics.	RDIS	Develop and apply active procedures to communicate information on r&d alternatives to the general public as well as educational practitioners.
	Distribute consumer information materials to personnel with dissemination functions within the region through mailings and regular personal visits both proactively and in response to individual requests from these disseminators.	Rxs	Collect and exchange user and analyst information on the strengths and weaknesses of r&d outcomes.
	Assist the RDIS and regional disseminators in identifying and developing resource materials appropriate to regional users' needs.	Rxs	
	Establish and maintain a small-scale regional collection of r&d resource materials to provide quick and direct access to consumer information materials.	Rxs	
	Adapt selected r&d consumer information materials to high priority needs of regional users.	Rxs	
1.2 Make high quality r&d outcomes more accessible to practitioners.	Identify products described in NIE Catalog which are not available.	SSS	
	Establish and maintain a small-scale regional collection of r&d products in RDx priority areas.	ARL Rx NWREL Rx	
			Identify quality r&d products that may be useful to linkers or practitioners and are not likely to be made available using present mechanisms.
			Make the best and most needed of the above r&d products available to practitioners.
1.3 Help practitioners use a mix of r&d outcomes efficiently and appropriately.			Establish incentives for r&d producers to produce all quality products.
			If additional funds are available contractors could provide technical assistance with r&d outcomes in their areas of expertise such as "Aesthetic Ed." (Several labs have proposed this work in their 3-5 year plans.)
2.1 Increase the availability of information about practitioner needs to help the r&d community make decisions on the production and delivery of r&d outcomes.	Collect data on regional educational needs identified by SEAs from statewide needs assessments or information requests from state, intermediate, and local linkers.	Rxs	Perform a large synthesis of many nationwide data to determine major priority need areas.

Objective	Activities To Date	RDx Contractor(s)	Future Activities
	Synthesize regional data on educational needs, determine priorities, and report at a regional level to the System Support Service, NIE, and other relevant groups.	Rxs	Synthesize information to determine specific needs and options. Communicate results with policy makers and r&d community.
	Select 3 RDx priority areas based on Rx information on needs.	All (RDx)	
	Develop conceptual framework and design and implement procedures for collecting and aggregating data.	SSS	
2.2 Increase the availability of information about exemplary locally developed practices which the r&d community may help refine, package and deliver to practitioners.	Survey procedures used to identify exemplary practices.	RRS	
	Develop conceptual paper on RDx role regarding exemplary practices.	SSC	
	Collect information on state identified exemplary practices in region.	NWREL Rx CEMREL Rx	Help identify exemplary practices at regional level.
2.3 Increase the availability of information on r&d outcomes and their use to guide future r&d work.	Collect information about the extent of use, and the usability of, r&d products in the region and forward to the System Support Service.	Rxs	
	Develop a r&d product tracking system and maintain an RDx-wide file of information concerning NIE and non-NIE r&d outcomes in high priority problem areas.	SSS	Have Rxs collect user data on key r&d outcomes. Share and aggregate the data nationwide.
2.4 Help the r&d community obtain and use the above information on r&d outcomes.	Synthesize the above information for final reports.	SSS	Need to develop special efforts to communicate information to appropriate members of r&d community.
3.1 Increase understanding of current disseminator activities, needs, and problems.	Develop and implement methodologies for the identification and description of dissemination activities within the Regional Exchange areas.	Rxs SSS	Will be able to benefit from and influence other studies of dissemination activities.
	Obtain and compile comprehensive information about resource organizations and personnel which will help Regional Exchanges.	RRS	
	Produce an inventory of human resources for dissemination training and consultation	LTS	
	Develop and implement a process for identifying linkage training and support needs.	LTS	Develop research based list of linkage competencies for specified linkage functions.
	Identify linkage training support needs in region.	Rxs	
	Develop a conceptual framework for linkage training.		
	Identify regional and extra-regional r&d information systems of potential usefulness to state and intermediate linkers.	Rx	
	Design an r&d program to create knowledge about information resources and their delivery.	RRS	
3.2 Provide brokerage or referral services to help linkers and subsequently r&d producers and practitioners identify and use dissemination resources effectively.	Revise and expand "Sourcebook" of linker training materials.	LTS	Merge efforts with NDN brokerage contractor for dissemination personnel to provide more service.
	Provide service to Regional Exchanges in the form of--	RAS	
	* Information about available resource organizations and personnel		

Objective	Activities to Date	RDx Contractor(s)	Future Activities
	• Recommendations on suitable resources for specific problems		
	• Assistance in making contacts with appropriate organizations and personnel		
	Identify and broker available sources of dissemination training for Regional Exchange users.	RxS	
	Assist Regional Exchange participants, upon request, in designing procedures for identifying, collecting, verifying and retrieving information on r&d outcomes and exemplary practices for their resource files.	RxS	
3.3 Provide direct help to linkers to enable them to acquire information, tools and skills to help practitioners identify r&d outcomes.	Design and conduct workshops for state and local personnel on using information resources.	RRS LTS	Team with NRIC and FPIE and other appropriate groups to work with practitioners in their selection of r&d outcome
	Provide Regional Exchange users with short-term assistance in identifying and resolving specific dissemination problems related to r&d outcomes and exemplary practices.	Rx	
3.4 Provide direct assistance to linkers or dissemination organizations to enable them to plan for and improve their linkage capabilities.	Deliver the following services to Regional Exchanges upon request: consultation, training, human/material resources, brokerage/referral, other services.	LTS	Broaden scope and extent of dissemination technic assistance to key disseminators if resources increase.
	Work with Regional Exchanges to design a training program to meet linkage training needs of each Regional Exchange, or to adapt existing training programs to meet those needs.	LTS	
	Assist Regional Exchange users in the analysis or evaluation of existing dissemination programs and activities.	Rx	
	Assist Regional Exchange users in conducting their own needs assessments and in examining alternative models and strategies for decision making by SEAs, ISAs, and LEAs.	Rx	
	Provide technical assistance to other RDx contractors and NIE for the implementation or improvement of their information systems.	RRS	

STRUCTURE OF THE R&D EXCHANGE

Figure 2 shows the organizational structure of the present R&D Exchange. The brochure attached as Appendix C describes the current participants in more detail. The history of the effort is described in Appendix B.

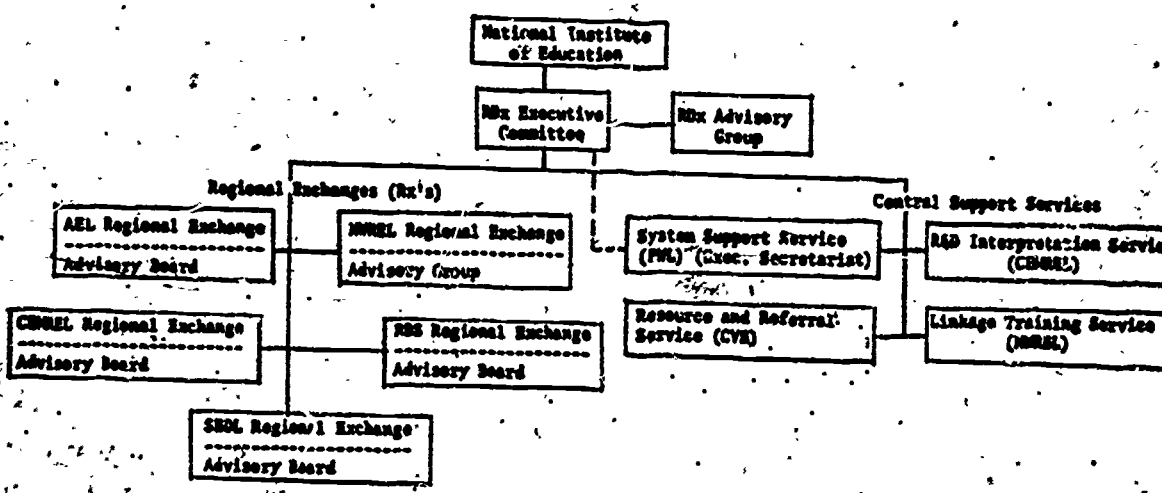
In addition to performing the sample activities outlined in the previous charts, NIE and all R&D Exchange contractors have additional management and coordination responsibilities. To the extent possible, these responsibilities reflect the RDx operational principles discussed previously. They include:

- establishing and using systematic internal operating procedures with each contract;
- planning for individual contractor as well as total RDx future activities;
- testing the feasibility of current activities and contributing information for overall RDx monitoring and evaluating purposes;
- revising current activities and sharing information with other RDx contractors and NIE;
- helping other RDx contractors carry out certain activities or functions.

Although all nine RDx contractors are performing specific tasks related to these activities, the System Support Service (SSS) contractor has specific leadership responsibilities for all activities related to RDx management and coordination. The System Support Service also has responsibility for representing the RDx as a whole to "external" groups --i.e., organizations which are not currently RDx contractors. Thus the SSS facilitates internal and external coordination of the RDx. Some activities include providing support for the RDx executive committee and

Figure 2

STRUCTURE OF THE R&D EXCHANGE



RDx advisory group; designing, developing, and coordinating RDx data management functions; providing technical assistance to RDx contractors; arranging for RDx publications and for RDx participation in national meetings; and establishing liaisons with other dissemination groups.

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APPENDIX A

KEY TERMS

Consumer information: analystic, interpretive information on multiple R&D based outcomes such as EPIE product reports, interpretations of research findings for teachers, etc.

Dissemination: A knowledge-transfer process which may consist of four levels of activities:*

Level 1: Spread: The one-way casting out of knowledge in all its forms: information, products, ideas, and materials, "as though sowing seeds."

Level 2: Exchange: The two-way or multi-way flow of information, products, ideas, and materials as to needs, problems, and potential solutions.

Level 3: Choice: The facilitation of rational consideration and selection among those ideas, materials and outcomes of research and development, effective educational practices and other knowledge that can be used for the improvement of education.

Level 4: Implementation: The facilitation of adoption, installation, and the ongoing utilization of improvements.

Exemplary Practice: A new or outstanding practice developed in a local education setting. A practice is exemplary to the degree it meets five criteria: (1) is viewed by practitioners as needed and worth initiating; (2) is successful/effective; (3) is exportable; (4) is reasonable in cost, time, and personnel required for implementation; and (5) has been systematically documented.

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*Adopted from the Interstate Project on Dissemination.

Feedforward: the process of communicating educational practitioner (and linker) needs for, or reactions to, R&D outcomes to the R&D community (sponsors, performers, trainers, etc.) with the intent of either (a) influencing the character and responsiveness of future R&D activity (including production and delivery) or (b) of providing evidence regarding the impact on or benefit of current and past R&D activity.

Feedforward activity: activities such as data collection, data synthesis and data reporting that focus on channeling user needs and user experiences with R&D outcomes to knowledge producers and educational decision-makers.

Knowledge transformation/analytical and interpretative product: a process of translating/interpreting R&D outcomes in terms of essential practices and conditions that can lead replication and/or adaptation by practitioners. The drawing of implications for practitioners is embedded in the definition.

Linkage: the establishing and maintenance of effective channels of communication between practitioners in schools and various knowledge-producing agencies.

Linkage system: the agencies—such as universities, publishers, RILs, State Departments, intermediate service agencies, LEAs—who collaborate to provide a link between the practitioner and R&D products.

Linkage support system: agencies—such as labs, centers, regional exchanges—which provide consultation, training, and the accessing of human and material resources to facilitate the operation of the linkage system.

Linking agents or linkers: individuals who help others engage in problem-solving by connecting them with appropriate knowledge, materials, and human resources and who help them in the use of these resources.

R&D outcome: the result of the R&D process. It may be a product, a model, a policy finding, or a research result. What sets R&D outcomes apart from other knowledge is that they are tested in the field on the relevant population and then adjusted accordingly.

R&D product: a tangible, transportable, self-contained outcome of the process. The R&D process involves a sequence of activities rooted in the scientific method in which research findings or relevant theory is translated into usable artifacts. The translation is then subject to evaluation and revision to ensure that the product(s) meets the needs for which it was designed.

R&D resource: resources are of two types: materials and human. Material resources include organizations and information products. Human resources include personnel who produce, are knowledgeable about, or disseminate R&D outcomes which would be useful to the RDx. Both material and human resources reflect the approach of systematic, disciplined inquire to educational problem-solving.

R&D tracking: the process of determining patterns and locations of R&D outcome utilization and impact within the educational community.

Technical assistance: provision of support to participant groups for the purpose of solving problems in planning, implementation and evaluation of dissemination plans, of providing or brokering training in dissemination skills, of providing access to information about R&D outcomes and resources.

Thin-market materials: R&D products, programs or practices that are designed for a small yet specific segment of the educational community, which are unsuited to a mass-market commercial distribution, and expensive to install and/or maintain on a per-student basis.

APPENDIX B

Summary of the R&D Exchange Planning Process up to 8/77

Since the School Practice and Service Division of DRG received early permission to limit the competition for the original 5 months planning awards (October 1976 - February 1977) to the NIE-funded educational laboratories and centers, it was possible to engage in collaborative planning for the initial official request for proposals, which was issued in July, 1976.* To do this, NIE circulated drafts of this RFP to all the labs and centers and USOE regional offices for their reactions. NIE staff also held discussions with labs and centers, USOE regional and other offices, ERIC clearinghouse directors, and SEA representatives about this proposed "R&D Dissemination and Feedforward System" now called the R&D Exchange.

The original 15 proposals from the labs and centers were reviewed by NIE staff as well as the following types of individuals: officials from USOE and NSF, an intermediate service agency representative, a publishing company representative, an educational consumers' organization representative, and an expert in R&D management. Based on these reviews, five 5-month Regional Information Exchange contracts (later to be shortened to Regional Exchanges) were awarded to Appalachia Educational Laboratory, CEMREL, Northwest Regional Educational Laboratory, Research for Better Schools, and Southwest Educational Development Laboratory. The remaining central support types of contracts included: FWL for System Coordination and Data Management Planning Contracts (later to be combined into the System Support Service), CEMREL for Consumer Information on R&D Products (later to become R&D Interpretation Service) and CVE for Research and Policy Interpretations (later to become Resource and Referral

*A dissemination Special Relationship Request for Proposals (RFP)) to Establish an "R&D Dissemination and Feedforward System: A Consortium of R&D Producers Disseminating and Gathering Consumer-Oriented Information about R&D Products and Outcomes." Limited copies available from NIE. Permission for limiting this competition to NIE funded labs and centers was based on (1) legislation and congressional intent for NIE to give its labs and centers special status and funding, and (2) the appropriateness of the labs and centers for the proposed dissemination work -- for example, the labs and centers had engaged in previous efforts to disseminate each others' products.

Service). During the first five months the contractors for Training for Dissemination and Utilization (later to become NWREL, Linkage Training Service) were coordinated by another NIE project. However contractors representing this project worked closely with the Dissemination and Feedforward System (later to become R&D Exchange). Where possible, after initial funding, the initial proposal reviewers as well as additional SEA and ISA representatives and dissemination experts continued to advise NIE and RDx contractors. NIE also was able to secure assistance from Drs. Radnor and Havelock and their associates to help the NIE staff and contractors increase their understanding of the theoretical and policy issues involved in establishing this R&D Exchange.

The Regional Exchange contractors spent their major efforts in collaborative planning with USOE regional office staff, SEA staff, and to a more limited extent, staff from ISAs, LEAs, and other groups with dissemination responsibilities. Tangible results of this collaborative Regional Exchange planning included agreements on pilot activities specified in the R&D Exchange contractors' 9 month continuation proposals and individual Regional Exchange "Baseline Reports" on dissemination activities and needs in their region. A report by Paul Hood and Donna Lloyd Kolkin at FWL, "A Summary of the RIE Baseline Reports," Draft 1/5/77, provides a useful integrated description of the dissemination of educational practices in the 33 states which were participating in the first 5 months of R&D Exchange System planning.

All the 9 month continuation proposals were funded with the original lab/center contractors although (as previously mentioned) the names and functions of the central support service contractors were changed somewhat. During the current 9 month planning and feasibility testing period, the R&D Exchange contractors and groups and individuals working with them have been developing initial operational plans. The primary NIE funds to support this operational work will again be from the part of the NIE budget allocated for the sole use of the educational laboratories and centers. It is hoped that the labs and centers will propose this work as they indicated in their preliminary 3-5 year plans which were reviewed by NIE in June 1977. In FY 1978 and subsequent years we hope that additional (non-lab and center) resources will be available to support regional exchanges in geographical areas far from the labs and centers and to support additional central support services.

The *Research and Development Exchange* (RDx) is an emerging federal initiative to encourage closer interaction between the worlds of educational research and school practice.

The RDx is operated by a consortium of regional educational laboratories and a university-based research and development center. Activities are being planned and tested during 1977 under sponsorship of the School Practice and Service Division, Dissemination and Resources Group, National Institute of Education DHEW.

The goal of the RDx is reflected in its name: to create an *exchange* of information. Researchers and developers communicate the results of their work to educational practitioners. Simultaneously, the practitioners use the RDx to relay information about their needs to researchers, developers, and policymakers. Thus the RDx encourages practitioners to influence future r&d programs and policies, while it informs them about available r&d outcomes.

Currently, the Research and Development Exchange consists of

4 central services and

5 regional exchanges working through

33 cooperating state departments of education

At the end of the planning phase, November 30, 1977, the RDx may change as current efforts are modified and new activities are initiated.

For now, the *regional exchanges* conduct both dissemination and "feedforward" activities in their respective regions of the country (see map). Dissemination involves providing practitioners with access to information that will allow them to match r&d outcomes to their needs. The goal is to increase the availability and to improve the quality of information about r&d outcomes in areas of critical user need. Feedforward involves developing techniques to enable practitioners to communicate their needs, concerns, and findings back to the r&d community. While researchers and developers have used feedback techniques to fine-tune products and processes, the intent of feedforward is to help practitioners actually influence the character and responsiveness of future r&d work.

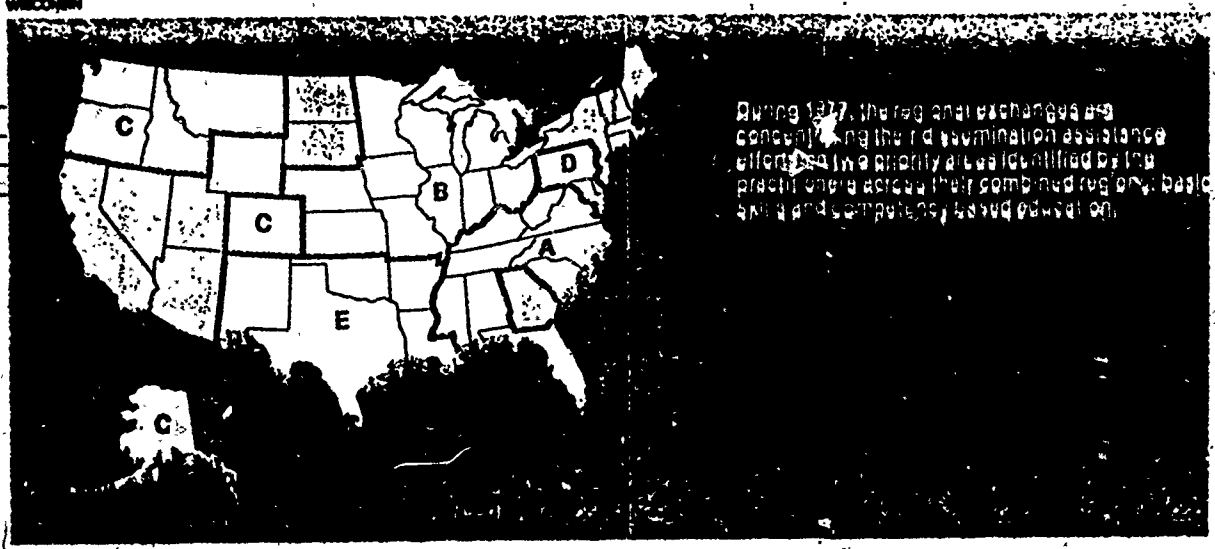
The regional exchanges serve the educational practitioners primarily through intermediate linkages affiliated with the state departments of education. That is, each cooperating state department has one or more contact persons. Schools, then, call on these linkers when in need of human or material resources. The linker, in turn, refers questions or requests as necessary to the regional exchange.

The regional exchanges serve the state departments in several ways. They function as a central depository for information and products, provide referral services, and perform technical assistance. Also, the regional exchanges facilitate

The five regional exchanges and their cooperating states are:

Appalachia Educational Laboratory — A
Charleston, West Virginia
ALABAMA
FLORIDA
KENTUCKY
MISSISSIPPI
NORTH CAROLINA
SOUTH CAROLINA
TENNESSEE
VIRGINIA
WEST VIRGINIA

CEMREL, Inc. — B
St. Louis, Missouri
with Mid-continent Regional Educational Laboratory
Kansas City, Missouri
ILLINOIS
INDIANA
IOWA
KANSAS
MICHIGAN
MINNESOTA
MISSOURI
NEBRASKA
OHIO
WISCONSIN



During 1977, the regional exchanges are concentrating their examination assistance efforts in the priority areas identified by the practitioners across their combined regions: basic skills and competency-based education.

Northwest Regional Educational Laboratory — C
Portland, Oregon
ALASKA
COLORADO
IDAHO
MONTANA
OREGON
WASHINGTON

Research for Better Schools, Inc. — D
Philadelphia, Pennsylvania
DELAWARE
MARYLAND
PENNSYLVANIA

Southwest Educational Development Laboratory — E
Austin, Texas
ARKANSAS
LOUISIANA
NEW MEXICO
OKLAHOMA
TEXAS

CHAPTER TWO

THE RDX SYSTEM: CONCEPTS, STRATEGIES, PRACTICES -- AN OVERVIEW

Michael Radnor
Robert Rich
Durward Hofler

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In the fall of 1976 collaborative planning was initiated between NIE and educational laboratories, state education agencies, and United States Office of Education regional offices. The main motive for holding these planning sessions was to begin to formulate strategies for the dissemination of educational research results to practitioners and the "feedforward" of the needs of these practitioners to the researchers; presumably, over time research could, then, be responsive to practitioner needs. The institutionalization of this effort has become known as the Research and Development Exchange (RDx).

Given the exploratory nature of the planning effort and the attempt to operationalize a new, innovative R&D system, NIE felt a need to gain some background on the conceptual and operational issues central to the development of this system.

The Center for the Interdisciplinary Study of Science and Technology (CISST) at Northwestern University has had a good deal of experience in dealing with issues related to R&D management in the field of education. For example, in October, 1976, we completed a policy analysis for the National Institute of Education on Agency/Field Relationships in the Educational R/D&I* System. This analysis attempted to relate NIE's mission and activities to the broader field of educational R&D, and it included a major section on issues of dissemination. A number of similar studies were in process (see Radnor and Hofler 1977).

Given this experience in the development of relevant conceptual frameworks and in consort with the several policy analyses being undertaken by us for NIE, we were asked to commission a set of papers that would identify guidelines, opportunities, and questions that should be built into designing each component of the RDx system over time.

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* Research, Development and Innovation -- see Radnor, Spivak and Hofler (1977) for a full explication of this concept.

This volume contains these papers, together with our introductory synthesis. But first, let us examine the purpose and objectives of this RDx system.

I. PURPOSES AND OBJECTIVES OF THE RDx SYSTEM

1. Background

Since its establishment, the National Institute for Education has been concerned with the extent to which educational R&D is being effectively disseminated; the extent to which R&D is affecting educational practice; and the extent to which the R&D community is responding to the needs and problems of educational practice.

In trying to be responsive to practitioner needs, NIE through its Dissemination and Resources Group (DRG) has begun to explore new ways of identifying practioner needs and bringing these needs to the attention of funding agencies and educational researchers and developers. As already indicated, DRG engaged in collaborative planning which resulted in the institutionalization of the RDx system.

Klein, McCann, and Saily* point out in their chapter that the RDx system is most concerned with addressing three major problems:

1) How can practioners' understanding and use of R&D outcomes be increased?

2) How can R&D outcomes better reflect practitioner needs, concerns, and findings?

3) How can the quality and efficiency of organizations and personnel involved in linking R&D outcomes with practitioner needs be improved?

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* All actively and directly involved in the RDx design: Klein as the NIE project monitor; McCann and Saily from two of the participating organizations.

In planning for this R&D system, several important assumptions were made about R&D outcomes:

1) R&D outcomes are not used as extensively as they could (and should) be.

2) Practitioners are inherently receptive to using externally-developed R&D-based outcomes.

3) Existing R&D outcomes are of sufficient merit to warrant their use.

4) R&D outcomes that are available may not have been disseminated sufficiently.

5) R&D outcomes could become more relevant to user needs.

In the early planning sessions for this system, two other dimensions were given serious consideration: (a) R&D coordination may best occur at the regional level; and (b) the current methods for "feeding forward" information about practitioner needs to researchers and developers are totally inadequate.

Organizationally, according to the theory behind the RDx system, it would be organized according to the following principles:

1) Its activities would be complementary and supportive of other agencies.

2) It would be a coordinated effort.

3) It would explore and experiment with alternative R&D

management strategies and outcomes.

4) It would use a linkage/brokerage strategy; i.e., linking local practitioners with R&D resources.

5) It would depend upon NIE for financial support.

6) It would work closely with existing R&D agencies.

Structurally, the RDx system was to be set up quasi-hierarchically; i.e., the National Institute for Education (NIE) would coordinate five (at that time) regional exchanges which would take advantage of support services offered to each of them. Each regional exchange would also have an advisory board to help along with its operations. The support services are thought of in terms of technical assistance and advice as well as providing overall training to participants.

Clearly, NIE viewed the RDx as a system which could potentially fill gaps in the area of educational R&D and its linkages to practitioners by:

1) Providing an effective feedforward component that, over time, would have the potential of guiding applied R&D so that it would be directly relevant to the needs of practitioners in state and local educational agencies as well as teachers in the classroom.

2) Increasing the access to R&D outcomes for practitioners -- thereby increasing the quality of the research they would be able to use.

3) Improving the quality and efficiency of organizations, activities, and personnel who are involved in linkage activities -- including providing services to help linkers acquire up-to-date information.

2. CISST Orientation

In the context of exploring the development of a new R&D system, critical issues emerge with respect to the overall purpose and objectives of the system: Is there a need for an R&D system of this kind, i.e., with a feedforward component? Is NIE ready to adopt and implement a full-scale R&D system at this time? Does the RDx structure represent the best way of designing an R&D system, given the state of the art in the field of R&D management? Should NIE be concentrating on regionally based centers and labs?

It may, of course, have been that the political realities were such that it was necessary to do something at that moment in time in terms of "being able to document results." Clearly, one way to operate within the demands of the political environment was to use existing labs and centers. This may have been sufficient justification in itself for operating within the assumptions of this R&D framework.

In light of these realities, and keeping these broader questions related to the purpose of the system in the back of our mind, we set out to identify the guidelines, opportunities, and questions that should be built into designing each component of this system.

This set of papers does not explore (at any length) questions related to the purpose and objectives of the RDx system. Instead, most papers utilize the structures and objectives of the RDx system as the starting point for their work. However, in the process of analyzing individual components, questions will be raised which relate to the overall purpose and structure of the RDx system, and beyond that to the design of information dissemination and exchange systems for educational innovation, in general.

II. IMPLICATIONS OF THE RDx STRUCTURE FOR SYSTEM DEVELOPMENT

There are other important issues, beyond general questions related

to the purpose and objectives of the system, which relate to the viability of the system, and methods for implementation which deserve attention.

1. Viability of the System

The questions/issues related to the viability of the system should be raised in the context of thinking about the overall system. In this sense, this discussion precedes our analysis of individual components or overall frameworks:

1) Is the regional level best suited for the operational management and coordination of the RDx system?

2) Given the different levels of government involved in this system (i.e., federal, state, local, regional), and the roles to be played by intermediaries/linkers, is a system of this kind manageable? Will interorganizational conflicts constrain the successful development of the concepts behind this system? In this context, one should be particularly concerned with jurisdictional disputes between various levels of government and the tendency of all organizations to protect their turf; as a result, coordination and management of such a system is likely to be exceedingly difficult.

3) Who (or which group) can coordinate such a system?

4) Is the feedforward notion a feasible concept? Can a system truly operate with institutionalized mechanisms of this kind?

5) Does the field of educational research produce special problems for the development of an R&D system? Education is a derivative field; it draws insights and methods for research from other disciplines. This tendency tends to limit the amount of innovation that is possible in the educational area. In addition, education tends to be a reactive field. It has not been paradigm setting or path breaking, but rather has gone along with the tide. As a

result, many complex, conflicting findings tend to emerge in this field of research; it has also been difficult to identify experts whom the educational community as a whole will recognize as "legitimate." In being reactive and derivative, educational research has also tended to develop few standards for quality control and validity testing. Consequently, problems of information proliferation are salient in these areas. These trends make the goals of the RDx system extremely difficult to implement.

2. Implementing the System

In addition to these issues related to viability, there are several important issues related to methods for implementing the RDx structure:

1) Obviously a system of this kind must be built up over time --it cannot be put into place as a finished product. Thus, at different points in time, we will be dealing with more or less mature systems and individual components of the system. Of what steps or stages will the implementation process consist? How can it be facilitated? What steps can be taken at the beginning stages of the system and what functions/components can be developed at a later point?

2) What training will the linkers require? What models of linkage might be tested in the RDx context? What has educational R&D learned from past linkage efforts?

3) In general, what types of personnel would be best suited to fill the various positions in the proposed RDx system? This theme is closely related to the concerns about management and interorganizational relations raised above.

4) Given the fact that this system represents an innovation, can the diffusion of innovation/planned change literature and experiences of practitioners in this area shed light

on the development of this system and provide some guidelines.

5) What does the literature on knowledge utilization and application teach us about increasing levels of use of educational R&D? Does this literature provide us with any guidelines?

6) What support services should be provided/offered by the centers responsible for serving the research and development exchange?

7) What incentive systems can be developed to facilitate the realization of the goals set out at the planning period for the RDx system? Much of the literature on interorganizational conflict and management would seem to indicate that individual and organizational incentive systems operate against the successful development of such a system.

8) How will this system be evaluated? What types of monitoring devices can be devised to aid in the development of this system?

9) What synthesis/transformation processes should be adopted by participants in the RDx system to translate research findings into practice?

These issues related to viability and methodology for implementation are meant to provide some overall points for background thinking as one thinks about analyzing various components of the RDx system.

III. CONCEPTUAL FRAMEWORK FOR ANALYSIS

Given the planning and objectives behind the RDx system as well as the set of issues raised above, we approached the task of commissioning

a set of papers which would raise key questions and issues that should be considered by those responsible for the RDx system, by employing some of our previous work on conceptual development.

In the Agency/Field Relationships report (Radnor, Spivak and Hofler 1976), certain realities concerning educational R&D are recognized:

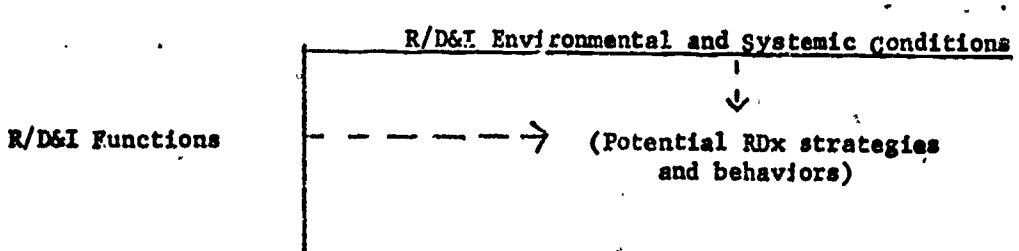
> ...For all its looseness, its inadequacies, there is an educational R&D system to be dealt with and NIE is a critical element in that system. What is done in one area or in relation to one issue will likely affect other areas and have impact on other issues. For example, the build-up of development efforts in the past has had implications for the state of Applied Research and the needs and opportunities for Dissemination now...
>
> The recognition of the current state of educational R&D (including the total innovation process) is as critical as the recognition of its sytemic character. It is loose; gaps are characteristic; and inadequacies are all too common. In short, it is a very 'immature' and weak R&D system...(p.i).

These same realities affect the development of the RDx system; they should be recognized.

A complete analysis of R/D&I functions would require examination of how the interaction of NIE's purposes, as manifested in the R/D&I functions, and mediated by the systemic and environmental conditions, determine agency (and individual) behaviors and consequently strategies in relation to the field. The above statement would imply at least a four dimensional analysis. As a simplified step, one can consider each of the R/D&I functions separately in relation to the combination of R/D&I systemic and environmental conditions, as shown in Figure 1:

Figure 1

R/D&I Matrix



The cells of this matrix are the appropriate R/D&I behaviors which can be built into strategies that individual participants can pursue.

Basically, by this matrix we are saying that it is necessary to specify/consider environmental factors (e.g.: political constraints, limitations set by operative funding patterns); conditions affecting R/D&I development (interorganizational relations; stages of development related to mature and immature systems); and the activities part of the R/D&I system (e.g.: knowledge synthesis, marketing, dissemination). There are important environmental and systemic conditions that are related to each R/D&I system activity.

This framework can be employed to analyze structures and behavioral patterns related to the development of the RDx and similar systems. The authors commissioned by us will be writing about R/D&I system activities (e.g.: knowledge synthesis, linkage) and/or environmental and systemic conditions. Having conducted the individual analyses for selected R/D&I functions, it becomes possible to consider the implications for strategies which would affect a dissemination and information exchange system as a whole. Finally, the strategies can be converted into scenarios in which patterns of hypothetical (or actual past or contemplated information exchange-related behaviors) are analyzed to suggest likely impacts if the system is implemented as formulated.

IV. OVERVIEW OF COMMISSIONED PAPERS

With this analytic framework in mind, we were concerned with commissioning papers that would provide both conceptual and practical tools (i.e., guidelines, steps/stages for guiding system development, indicators to monitor development) that teachers, administrators, policy makers, state and local officials, and federal officials could take away with them after reading the package of papers.

Each participant in the present RDx system and other such efforts as might arise would be able to read the package of papers and find some

answers to the following type of questions: How should I be monitoring system development in the area with which I am most concerned? What are some of the indicators which show how the system is moving from less to more mature stages? How can linkage functions be facilitated in the area I am most interested in?

In attempting to address these key issues, we contracted for a set of papers in the areas that we, in consultation with NIE, felt were most critical for the successful development of the RDx system:*

1) What does the diffusion of innovation literature and experiments teach participants in the RDx system? RDx can be viewed as an innovation; the experience of those who have overcome the barriers to innovation may be extremely useful to RDx participants. In addition, the diffusion concept may be particularly important in the area of system development. Zaltman and Sikorski have written a paper which summarizes tested principles of innovation that speak to the goals of the RDx system and the needs of individual participants.

2) What strategy should be developed for implementing the RDx system? What constraints and obstacles face the implementation process? What are the various stages of development through which the RDx system is likely to pass; what issues/problems should be addressed at each of these stages? Are there other efforts at system implementation that may serve as a model for the RDx system? Bean and Rogers attempt to address each of these questions in their paper. Specifically, they provide an analogy to the Agricultural Extension Service --what can be learned from this experience, and in what ways is the RDx experience

* For the sake of simplicity of exposition we will refer to the RDx system from here on, but we wish to emphasize that we view the discussion of issues to have much wider applicability, beyond the current RDx effort.

likely to be unique? This theme is particularly important because it cuts across all of the papers. Each of the papers must be concerned with developing "building blocks" over time and with "staging and phasing" -- i.e., system development on a step by step basis.

3) What are the interorganizational conflicts, barriers, and opportunities which are likely to affect system development? In the educational area are there particular interorganizational conflicts to be dealt with? Specifically, within the context of the RDx, are there likely to be problems resulting from the different levels of government involved with the system? Also, what are the bureaucratic conflicts that are likely to face this system at different stages of development? What guidelines might be followed by RDx participants to minimize these types of conflicts. The paper by Majkowski and Gross address these questions--from a conceptual and theoretical level as well as from the day-to-day, step-by-step approach. These approaches inform participants about the history of these types of conflicts and their likely manifestation within the context of the RDx system. This theme is another which cuts across most of the critical issues facing RDx participants.

4) How can research products best be transformed into products that are usable to clients, practitioners, administrators, and policy-makers? Knowledge synthesis/transformation processes have traditionally been thought of as being responsible for this type of translation activity. The synthesis process has been thought of as a means of communication between producers and users of research. Indeed, NIE has devoted substantial resources to the development of synthesis products on the assumption that it will help to facilitate the use and feed-forward of R&D products. What has been the history of these efforts? What are the major obstacles and barriers facing

those interested in synthesis? Should synthesis be thought of as the major means for communicating complex research findings to RDx participants? If so, is there an approach to synthesis/transformation which can be developed to facilitate the realization of the RDx goals? Rich and Goldhar attempt to address these questions in their paper. This R&D activity is critical because it represents a key component in translating/linking knowledge into action.

5) What models of linkage and research utilization should be employed in this system? What has been the history of linkage efforts in the past? What steps should be followed by linkers, on a step by step basis, for implementing the goals of this system? What guidelines can be offered to linkers in terms of successfully bringing together the producer and user communities. Lingwood and Havelock address these questions in their paper which reviews linkage models and practices as well as providing a recommended set of strategies for RDx participants.

6) What do the literature and practices in the area of marketing have to offer to RDx participants? Can marketing principles be used in implementing the RDx goals? Are there any marketing strategies that would be particularly appropriate for the development of this system? Kotler et. al. address these questions by analyzing what marketing concepts have to offer this system, how various marketing strategies have been used in the past, and what specific strategies might be appropriate at various stages of system development.

7) What methods of monitoring and evaluation should be built into the development of this system? Are there formative evaluation efforts that should be developed for purposes of feedforward? How can monitoring be built into the positive

development of this system? What types of monitoring are most appropriate for this system? How does monitoring fit into the development of an overall organizational/systematic memory? What are the incentives for monitoring and how can this system be operationalized? These are some of the key questions focused on by Weiss et al. in their paper on monitoring the RDx system.

This set of papers is, of course, to some degree, an artifact of NIE and RDx interests as well as available resources and expertise. We obviously could not commission a paper on every potentially relevant subject/issue facing RDx participants. It is important, for example, that conceptual and operational work be done in the areas of incentives and of personnel as they relate to RDx system development. It would also be important for further conceptual work to be completed on the notion of "feedforward". These gaps are only touched upon in the other papers.

V. OVERARCHING ORGANIZING FRAMEWORKS

Given the individual themes to be addressed by the authors -- related to R/D&I activities and/or environmental/systemic conditions — and the general concerns of the architects of the RDx system, we considered several areas of research which could potentially provide an overarching framework for organizing thoughts about the overall RDx system. The tested areas in the literature on R&D management and system development which could provide such a framework include:

1) The diffusion literature (diffusion of innovations) would advise RDx participants to select a few key users for intensive distribution/assistance in relation to a specific product (or limited set of products), with the assumption that other users will follow the lead of the key users with the facilitation of the feedforward component of the RDx system. This conception would call for services which

could be characterized as proactive, direct, and focused on selected users and products.

Related to analyzing this framework, several key assumptions made in the literature should be underscored:

(a) when the opinion leaders (key users) are in place, the spread of the innovation will readily follow;

(b) the spread/diffusion of the innovation can be mapped linearally, and followed (monitored) step by step; and

(c) innovations are considered to be a priori valuable.

Relative to adopting this framework as a guiding force in the development of the RDx system several key questions come to mind:

(a) What specific user needs should be the basis for diffusion efforts?

(b) Who will select the priority user needs to be addressed?

(c) What is the anticipated time span for more widespread diffusion to other users?

(d) Is this an acceptable time span?

2) The marketing literature would advise RDx participants to formulate a strategy for distributing specific products to selected sets of users. For example, one could formulate

a strategy for marketing twenty core products; these products should only be ones that are "proven". These should also be products for which a strong need has been identified. Moreover, they should be products that can be disseminated and implemented by the users receiving them. This conception would call for direct, proactive services; it also calls for someone who is willing to take the lead in being a "product advocate".

It should be clear that marketing represents a proactive process. In terms of a philosophy of operations, the marketing model represents an active approach. There may be a blind spot in this approach in overdoing the "push aspects" of "active operations".

In addition, this framework raises some important questions:

(a) Who determines and insures for user implementation?

(b) Who selects the key products to be marketed?

(c) Is product selection to be made on a regional or national basis?

3) The technical assistance literature would advise RDx participants to focus on the needs of users in relation to selection, implementation, and utilization of products. In relation to this goal, service would be responsive to client generated needs, related to a specific product, and directly oriented toward problem-solving. Unlike the previous two frameworks, services might be indirect or direct.

Some of the key questions left open in this framework include:

(a) What types of skills are needed by users in relation to adopting specific products?

(b) What personnel and institutions are available and capable of assisting in this effort?

(c) What are the costs to establish and maintain this type of system?

(d) In what ways could the RDx system insure users that they could obtain the necessary help to implement R&D products?

In focusing on the needs of users, this model also raises the fundamental question: What is the RDx role in light of the operations of other organizations involved in making the technical assistance model work?

As with the marketing model, it may be that a user driven model may be overdone on the "pull side" in the same way that marketing may be overdone on the "push side". Perhaps, one should be moving toward a balance between various approaches.

4) The consumer-information based literature focuses on providing users and/or intermediaries with packaged information about what R&D resources exist within any given system. Intermediaries and users are also given the important characteristics or attributes of these resources; i.e., type, quality, costs, supplementary resources needed for implementation, etc. The nature of the service provided is reactive (upon request) and limited to a specific, small product line. The service may be characterized as direct or indirect.

There are some issues which are left unanswered by this framework:

(a) What is available and can be produced on a short-term basis?

(b) What quality level is assumed in relation to the needs and capabilities of users?

(c) How feasible is the packaging and synthesis implied?

All of these frameworks have some weaknesses. As already indicated, models which are totally either user-driven or top-down may lead to inappropriate distortions. We need to strike a balance between scientific and marketing oriented models (see Lingwood and Havelock for an example of this).

However, these frameworks, drawn from recognized and tested literatures, have several core elements that should be underscored:

1) an emphasis on constraining the initial efforts of the R&D system to specific, limited product lines (using different language, each model tries to start with a limited set of materials);

2) providing services which are accessible to users in terms of cost, user training and capabilities, and implementability;

3) designing a system which is directly responsive to user needs (either as defined by the user or by some intermediary linker for the user); and

4) formulating a strategy for step-by-step implementation of

the overall system. These core elements will be recognized in the analysis presented in each of the contributing papers.

VI. ORGANIZING FRAMEWORK FOR THE PAPERS

Given these overall frameworks for consideration, it is essential to specify the environmental and systemic conditions which will play a key role in system design and building:

1) The political context or environment -- What legal constraints exist: local, federal, state? Who are the key decision makers and/or "high influence" persons? In relation to which users? In relation to which intermediary organizations? What views do they have that could significantly effect system development? What special interest groups exist, what is the nature of their influence?

2) The regional environment -- What are the implications of this choice for the system development? What constraints are immediately put on the system because of the history of coordinated efforts in this area?

3) The funding environment -- How does NIE's funding and coordinating role affect the development of the system? Does it place any constraints on system development? Will innovation be facilitated or constrained by NIE's control of system funding?

4) The nature of the demonstration methodology -- In the RDx system emphasis could be placed on the direct linking of a "user need" with a "user" who is already utilizing a relevant product or program. Thus, some users would become, in effect, "live demonstrations" for other users. Does this place any constraints on system development?

5) Interorganizational relations -- What issues of contention are likely to arise between the various organizations involved in this effort? Will individuals and organizations be willing to live with the uncertainty (risk) involved in such a coordinated, planned effort? What management issues will become most salient?

6) Staging and phasing in relation to mature and immature systems -- What design steps should be taken first as this new function in the R&D system is implemented? What areas can be considered to be middle and long range concerns? What strategy(ies) should be developed to insure for successful implementation? What roadblocks are likely to come in the way of implementation?

7) Incentive and personnel systems -- Are there reward structures in place which will facilitate the development of this system? How can the participating organizations be encouraged to create rewards that will be consistent with system development? Are there particular personnal structures which would facilitate this process?

As already noted, this set of environmental and systemic conditions should be considered directly in relation to specific system functions (building blocks); i.e., "under x, y, and z conditions, building block A will operate, be constrained, thrive, etc." In identifying with what activities (building blocks) the RDx system should be involved, we are guided by several considerations:

1) What functions are other systems already performing?

2) In what functions must the RDx system be engaged?

3) In what functions would it be advantageous, but not required, for the RDx system to be engaged?

4) With what functions should the RDx system not (under any conditions) become involved?

5) What functions are limited by legal and/or resource constraints?

6) What functions would the system need help in implementing?

Given these overall considerations, the following functions (activities) seemed most important to consider from the vantage point of our deductive analysis:

1) Need identification -- Who can and should be doing this? Whose needs are being identified; i.e., users, regional, national. By what criteria? Are they to be focused or general?

2) Storing, retrieving, sorting, and processing of information -- This category of building block focuses on the mechanical process of organizing information, once it has been collected. Who can and should be doing this? Who is capable of doing it? What alternatives are available -- from a conceptual and technical point of view? Should these processes be developed on the basis of predicted needs or a more open-ended "responsive-to-needs" basis?

3) Knowledge synthesis -- How should this be done? Who can and should be doing it? What should be synthesized? Should different types of syntheses be developed in relation to different types of needs?

4) Quality control -- What is the nature of this process to be; i.e., panel evaluation, user reports? Who should be doing it?

5) Information transmission, linkage, user selection -- To whom should information be disseminated and when? By what type of communication media; i.e., person to person, written, conferences, live demonstrations? Through what channels should this communication go; i.e., LEA's, SEA's NIE, journals, intermediaries? Which product should be disseminated to which group of users and why?

6) Technical assistance -- What kinds of technical assistance do different users need in relation to different types of system activities? How critical would this technical assistance be for system implementation? What would be the cost of these services? What different modes of insuring for technical assistance are available or could easily be developed?

7) Monitoring and evaluation -- Who can and should be doing this? What functions can be served by these activities in terms of system development? At what points, stages in system development should this be taking place?

From another perspective, one might consider each one of these building blocks in relation to a specific user profile, and/or a profile for a user group. Figure 2 represents a way of thinking about this process. In terms of considering these activities each user in the RDx system would ask (this is analogous to general system considerations):

(a) what alternatives are available;

(b) at what cost;

(c) who could and should be doing it; and

(d) how is it being done at the moment?

Figure Two

SETS OF BUILDING BLOCKS

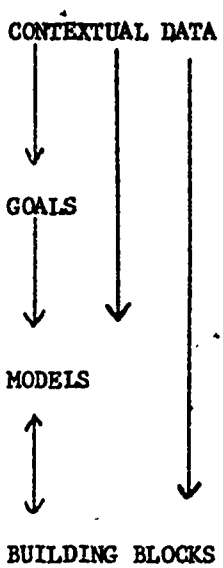
-Need Identification -Need Arousal -Need Assessing	-Storing -Retrieval -Sorting -Selecting -Quality Control	-Tailoring -Packaging	-Information Transmission -User Selection	-Technical Assistance	-Feed Forward	-Monitoring -Evaluation

Product/User Profile

What alternatives are available?
At what cost?
Who could do/should do/is doing?
How is it being done? Could be done?
What criteria could be/should be/are being used?
Proactive/Responsive?
Direct/Indirect?

This framework served as the basis for selecting the analytic papers written by our consultants. Each author was asked to approach his task with the framework just outlined. Specifically, the consultants who were asked to analyze a specific design model/ framework (Beam and Rogers; Kotler et al.; Zaltman and Sikorski) were also asked to include analysis of pertinent building blocks (activities) in relation to the RDx system design. Similarly, the consultants who were asked to focus on particular building blocks or activities (Lingwood and Havelock; Rich and Goldhar; Weiss, et al.) were also asked to relate the building blocks to some of the system design models being analyzed by other consultants. In figure 3 we have attempted to show how our overall framework is organized in relation to the development of the RDx system.

Figure 3 - Organizing Framework



We also felt that some attention should be given to other key concepts as we think about an overall framework for analyzing the development of the RDx system and the products represented by the consultant papers:

1) The notion of a fail-safe R&D system -- The system needs to be made fail-safe. It is reasonable to expect that users will from time to time have "bad" experiences with the RDx system, which when going through a learning curve may lead to premature and long term rejection. The reverse of this is also true: the positive experience should be reinforced and capitalized upon.

   Thus, it makes sense to involve users and user groups with several different RDx-related activities, such that if they experience failure with one source, they can go to another instead of rejecting the entire system.

2) RDx participants have to be careful to distinguish between mature and immature systems -- In the immature system there will tend to be a general lack of quality control and a low level of effectiveness in implementation. Users may be unaware of what is available for their use and they will lack the evaluative capability to distinguish between relevant and inappropriate products. Thus, in the early stages the R&D system must be developed to give special emphasis to the need to find, evaluate, categorize, store, and retrieve information about what is available.

   When the R&D system is more mature, a different set of conditions tends to exist: (a) products of quality and mechanisms for quality control are more readily available; and (b) users will tend to have a higher degree of familiarity with products; they will better know how to find,

select, and use new R&D products. Under these conditions, those responsible for system design and implementation can concentrate more on implementation and maintenance. We do not, however, imply by this that we expect these conditions ever to be well defined and "neat" in education. The nature of the phenomenon and its knowledge base would not seem to allow for this.

3) The importance of trust for the operations of the system -- A smooth functioning R&D system is based on trust -- trust in the information being disseminated, and trust in the source of information products. Quality control is key to building and maintaining trust -- quality control on the products and on the usage of the products. Linkers/intermediaries should avoid promoting a product under conditions that will or could potentially lead to its misuse.

In the context of the RDx system it is also important to note that in a social and practice based field, interpersonal mechanisms of communication tend to be seen as more trustworthy than printed and other impersonal media forms. This is especially true in such areas of innovation and even more so where there is a low level of system development and a high level of uncertainty. Officials always seek ways in which to avoid risk; impersonal means of communication only help to reinforce feelings of uncertainty and risk.

4) Replicability of R&D products vs. tailoring -- When considering any element of the RDx system it is important to make a distinction between the design stage of devising the R&D component and the subsequent operational stage of using it to achieve overall system objectives.

It takes a good deal of time to develop new, innovative R&D products. However, once they are developed, they

can sometimes be reproduced rather rapidly. The characteristic of replicability can be used in order to expand the impact of the innovation to a wider clientele.

Tailoring, on the other hand, is also very important -- especially in the early stages of development where trust in the system is rather low. Because of diversity among user organizations and their needs, it is probable that existing products will not quite "fit" user needs (or, as often, not be viewed as fitting by suspicious users). It should be the objective of the R&D process to clearly eliminate inappropriate products from dissemination to user groups, and to have available a variety of products that might relate to a given problem. The objective should be to meet user needs as closely as possible and to be able to create packages which can serve diverse groups of users. However, tailoring will have to occur to meet specific demands.

5) The personnel base -- It is essential for a dissemination system to be carried out in a highly professional manner. In education, a well trained group of specialists is lacking. Most of those carrying out dissemination and utilization activities appear to be practitioners by training. They are proceeding intuitively and learning their jobs through hard, often unsuccessful, experience. R&D mechanisms, strategies, and innovations are expanding far more rapidly with a far greater demand for trained personnel than are currently available. Thus, the RDx system will have to engage in training for dissemination, as part of its support service, as the system develops.

6) Problem focused R&D as a management tool -- There are many R&D systems which appear to be attractive on paper. In practice, they prove to be infeasible and unmanageable -- due, primarily, to the constraints/barriers which are put in the

path of implementation (interorganizational, personnel or jurisdictional disputes; etc.). One of the best ways to help insure for success is to concentrate on problem solving. We feel that R&D systems like the RDx should be oriented in this direction; i.e., participants should be moving toward gaining a clear picture of the problem on which they are working; information should be collected and disseminated as it relates to the problem at hand; and resources should be committed to those RDx activities which possess the clearest problem definition.

VII. MAJOR THEMES AND BUILDING BLOCKS -- A SYNTHESIS OF THE CONSULTANT PAPERS

The overall framework described in the last section was available to each consultant. When the drafts of the papers were available, it became clear that four major components or themes were (to a greater or lesser extent) covered in each of these papers:

1) Educational research -- Are there special problems related to the field of education which are important to point to in relation to the overall analysis being presented? Also, is there something about educational R&D systems which deserves special attention?

2) The regional context -- Is there anything about the regional basis for the system that deserves special attention? Will the analysis being presented apply equally well to all regional coordinating centers? Is there anything about the regional level as a point of coordination that presents particular problems for overall system design or for the design of a particular building block?*

*For a relatively complete discussion of this question of Regionalism for educational R/D&I see Hofler and Radnor (1977).

3) Interorganizational relations and management -- How does the overall system design or building block relate to a particular management approach? To what aspects of interorganizational relations should RDx participants pay particular attention?

4) Staging and Phasing -- How should the design or building block be implemented over time? In what order should specific steps be taken?

Given (1) the themes with which we started and (2) the cross cutting themes in each of the papers, it is appropriate to look at the intersection of the two.

1. Overall Frameworks/Designs for the RDx System

None of the overall frameworks that we began with served as an adequate model (by itself) for the overall development of the RDx system. The consumer information and the technical assistance models were least adequate as an overall framework for organization. Thus, we note that neither one of these two frameworks insures for (a) a fail-safe system; (b) trust; (c) feasible implementation procedures; and (d) a clear understanding of the problem definition that is being worked upon. In this context it should also be noted that the marketing approach suffers from many of the same problems. In addition, while the marketing framework attempts to insure for successful adoption of a product, there is a lack of emphasis on mechanisms and guidelines to insure for quality control -- substantively or in terms of personnel.

The diffusion framework has certain advantages in these respects. It offers a clearer, and possibly feasible implementation strategy. It also attempts to build in some fail-safe components. Implicitly, this framework is also concerned with trust. However, the crucial component of insuring for a problem solving orientation at all levels of the RDx system is missing.

But while each framework may have its shortcomings, each does contribute important inputs into an overall framework.

As already noted, the consultant papers suggest that the RDx system participants need to develop an overall balanced framework for the smooth and effective management (as well as implementation) of this system. The emphasis should be on management: guiding, directing, allocating resources, and implementing this R&D system in a planned fashion. Management also implies active involvement and direction of all system participants.

2. A Proposed Management Framework

The proposed management framework has several key components to it:

1) Both a push and pull aspect -- RDx should have a mix of pull strategies (such as suggested by Rich and Goldhar) and push strategies (such as suggested by Bean and Rogers).

2) The management approach would contain the process of specifying information value (see the Rich and Goldhar paper for fuller details). System participants would be asked to adopt the attitude: information is not valuable in its own right; information should not be collected for the sake of having more information around or for the sake of individual and/or organizational protection. Information should only be collected and processed when clearly defined problems have been identified. In addition to focusing the system on solving problems, this component of the overall management also helps to build commitment to the RDx system.

3) A staging and phasing component -- Each component of the system should be developed with a particular strategy for im-

plementation in mind. In terms of system design, participants should consider what stages they are likely to go through in developing a system from a less to a more mature state (see Bean and Rogers for further details).

4) A feedforward dimension -- Once the initial system is in place, practitioners should be informed about what research is available and researchers about practitioner needs. Hopefully, both communities' activities will be influenced by this exchange of information.*

5) A linkage dimension -- Trained and experienced intermediaries and linkers are key to the success of this system. This is especially true in the early stages of development where there is great uncertainty concerning outcomes and procedures.

Linkage activities must also be closely tied to the process of specifying information value and overcoming the inter-organizational barriers traditionally associated with non-utilization of educational R&D outcomes (see Lingwood and Havelock for further details).

VIII. OVERALL LESSONS LEARNED FROM THESE PAPERS

Beyond the overall considerations/factors already discussed in this chapter, it is important to point to some of the major points covered in our papers:

1) A considerable period of time is required for the development of the overall system.

2) In the educational area, the system is likely to go through

*L. Sikorski developed an internal RDx paper on this topic.

three stages:

(a) elaboration of the existing systems and networks to incorporate a local level linking element -- presumably through the careful use of trained intermediaries; in the early stages it is necessary to build on R&D elements that users are familiar with and trust;

(b) consolidation of the results of the first stage -- this phase emphasizes the learning from past experience by emphasizing the elimination of ineffective, unrewarding and unsupportable activities from the facilitator/linker role and placing increased emphasis on the positive aspects of the first phase of experience;

(c) institutionalization of the emerging structures through professionalization of the emerging structures and recognition of career tracks within the system.

This is the basic framework put forward by Bean and Rogers. In terms of system design the other papers in this collection are consistent with this approach:

1) Kotler et al. recommend the development of a limited product line in early stages of development.

2) Rich and Goldhar recommend the combination of packaged synthesis materials on a limited basis and the wide use of brokerage functions in early stages of development;

this is supposed to help increase commitment to the RDx system.

3) In the area of interorganizational relations, we, as a group of consultants, have also reached some agreement as to the major issues to pay attention to:

(a) The greater the ambiguity or vagueness of the systems functions and services as perceived by client/users, the more likely the clients will view the system as a threat or at least an activity which requires them to engage in great risk. Thus, they are likely to avoid contact with the organization.

This makes our recommended management approach all the more important.

(b) Since the RDx involves a collaborative venture among several organizations, the absence of ground rules or the lack of clarity about them can serve as a serious impediment to the development of effective, long-term interorganizational relationships.

(c) Cooperative ventures of the kind represented by the RDx require strong and effective leadership by individuals who manage one or more of the participating organizations.

(d) Poor planning will inevitably lead to the wreckage of interorganizational efforts. Organizations cannot successfully build viable interorganizational relationships on a totally ad-hoc basis.

(e) Interorganizational relationships that are effective will be enhanced by the existence of channels of communication which allow for frank and open interchanges.

(f) Lack of monitoring and evaluation procedures will also impede the overall development of inter-organizational relationships.

Finally, in terms of each of these papers we are able to present specific monitoring indicators and indicators for assessing system development from an immature to a mature system.

IX. FORMAT OF PAPERS

Each of the papers which follow are organized in roughly the following manner. They begin with an overview of the whole paper. They conclude with a summary of implications. For a first reading, and as something of an executive overview, it may be found helpful to read each of these introductory and conclusion sections first. The main body of the papers follow the overview and these should be read carefully by those with a strong interest in information dissemination and exchange in educational R/D&I, and especially by those with a stake in the RDx and similar systems.

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CHAPTER THREE

STAGING AND PHASING ISSUES IN THE DEVELOPMENT OF A DISSEMINATION/FEEDFORWARD SYSTEM IN EDUCATION

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*Dr. Bean's views and recommendations presented are his own and do not necessarily reflect the official position of the National Science Foundation.

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> The National Institute of Education was established in 1972 to provide a focal point for federal research and development (R&D) in education. More than 2,500 institutions conduct some form of education R&D, yet there is little coordination within the R&D system as a whole.
>
> (Harold L. Hodgkinson, NIE Director)

I. INTRODUCTION

The purpose of this report is (1) to identify the institutional elements needed to provide a functionally viable R&D Dissemination and Feedforward capability for education, (2) to specify alternative procedures for creating these elements, and (3) to discuss and evaluate alternative approaches to the sequential development and implementation of the required system elements.

The present report is one part of a larger effort by the National Institute of Education (NIE) to design an R&D Dissemination and Feedforward (RDDF) system for U.S. education. The ultimate users of the research-based innovations are to be primary and secondary public school teachers. Dissemination is concerned with communicating educational innovations from R&D sources to the ultimate users (teachers). Feedforward is concerned with influencing the directions of R&D, so that educational innovations will be produced that are more relevant, effective, and accessible to school teachers. The resulting innovations presumably will diffuse more rapidly if these innovations are consistent with users' needs. This strategy is the idea of "scratching where it itches." Naturally, such an approach assumes (1) that there are itches, (2) that such itches can be identified, and (3) that effective scratching can be found through R&D activities that will help cope with the itching. These three assumptions will be questioned and discussed later in this report.

Our basic point of departure in this report is the agricultural extension model, a reputedly successful and widely-copied RDDF system. We utilize the agricultural extension model as our reference system in the present report because (1) the authors are thoroughly familiar with the model as a result of our recent analysis of its development over the 50-year period beginning in about 1910, and its extension to seven other applications (Rogers, et. al., 1976), and (2) two of these seven extensions of the agricultural extension model are in education (the pilot project in educational extension by the U.S. Office of Education in the early 1970's and the National Diffusion Network of the USOE beginning in 1974).

We do not advocate that a close replica of the agricultural extension model should be established for U.S. education. Until now, however, the agricultural extension model has been the most important recognizable influence on the RDDF system in education. Lessons from agriculture for education must be carefully drawn, and must be adapted to the special characteristics of the U.S. education that affects research utilization. In two past cases that we analyze here-in, such modification seems to have been insufficient.

We shall review the background of the agricultural extension model in order to identify eight main features of that system:

1. A "critical mass" of "appropriate" technology.
2. A research sub-system oriented to utilization.
3. A high degree of user control over the research utilization system.

4. Structural linkages among the research utilization system's components.
5. A high degree of client contact by the linking sub-system.
6. A "spannable" social distance across each interface between components in the system.
7. Evolution as a complete system.
8. A high degree of control by the system over its environment.

These eight features will be briefly traced as they developed over time (1) for the agricultural extension model, and (2) for the two previous applications of this model in U.S. education, in order to determine what general lessons can be learned about the staging and phasing aspects of RDDF systems.

Then we shall apply these lessons to the development of an RDDF system for U.S. education today.

II. THE AGRICULTURAL EXTENSION MODEL

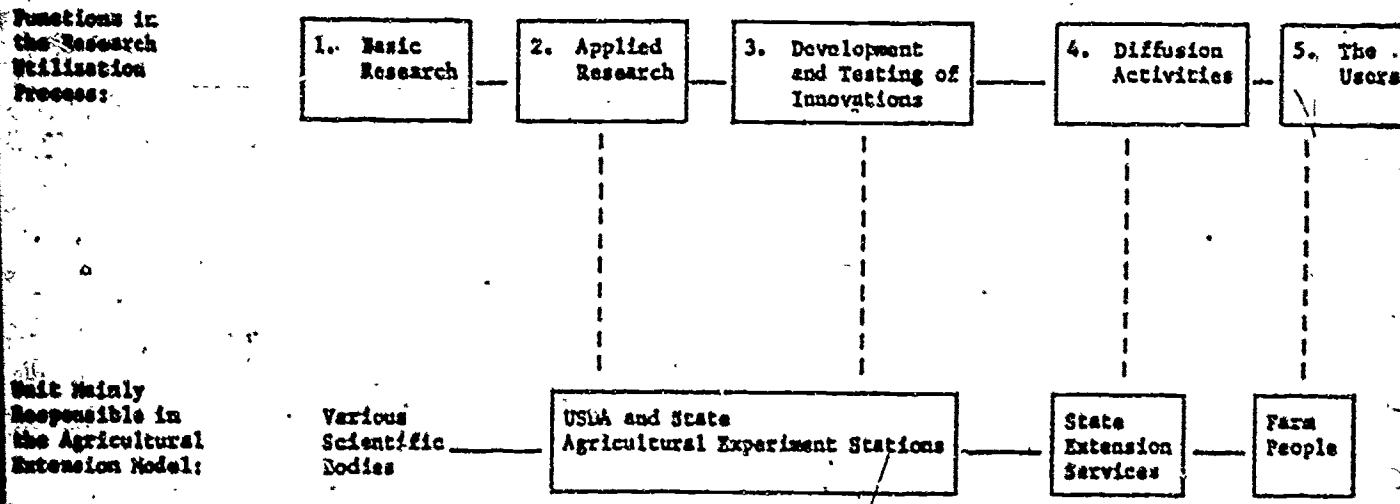
The agricultural extension model was a set of assumptions, principles, and organizational structures for diffusing the results of agricultural research to farm audiences in the U.S. This "model" is based directedly on the experience of an agency that diffused agricultural innovations, and that agency's program of activities (Figure 1).

Brief Historical Development of The Agricultural Extension Model

The Cooperative Extension Service was created by federal law. Its purpose, as expressed in the creating legislation, is to ". . . aid in diffusing among the people of the United States useful and practical information. . . and to encourage the application of the same." Here we review briefly the development of the U.S. agricultural extension model since the 1910's.

The history of the U.S. agricultural extension program cannot be divided neatly and paradigmatically into a series of evolutionary stages. Rather, there is a gradual alteration of the pattern of systematic interrelationships between technology creators, interpreters, and users.

When the extension service began shortly after 1910, it formed a linkage between the producers of agricultural technology and the users of these innovations, who were predominantly independent farmer operator-clients. The extension agent (the linker) for the most part carried this information in his head and/or in some immediate references. Agricultural technology was not particularly shaped by client demand, since there were in the early stages no mechanisms for feeding such demands forward into



FUNCTIONS IN THE RESEARCH UTILIZATION PROCESS AND CORRESPONDENCES WITH THE UNITS IN THE AGRICULTURAL EXTENSION MODEL

FIGURE 1

the research system. Thus the information flow in the early extension services was first to the county agent, during his university undergraduate training in agriculture, and then from him directly to individual farmers.

This relatively simple system soon became modified with the inclusion of feedback and feedforward systems to guide agricultural research into directions which county agents could identify as areas of immediate concern to their farmer-clients. The provision of large new amounts of public money for agricultural research (such funding began in 1887, but really began to increase sharply about 1920) stimulated the production of new technology, and created a demand for extension service subject-matter specialists to form a new link between the county agent and the technology-generating system (Figure 2). The pattern thus became one in which the county agent formed a link between the farmer-client and the state-level extension specialist, and so another layer of interpretation was created between the client and the knowledge resource system (Figure 3).

Meanwhile, forces were acting to change the nature of the client system. The general depression in agricultural prices which lasted through the period between the two World Wars exerted strong economic pressure on farmers, and drove out those whose operations were only marginally profitable. The farmers who survived were those who could accumulate capital and land and take advantage of the new technology which the extension services were making available. No hard data exist to judge the degree to which the county agents were offering technology that was accessible only to the wealthier farmers. However, in practice it was those farmers who could afford to adopt these innovations who remained in

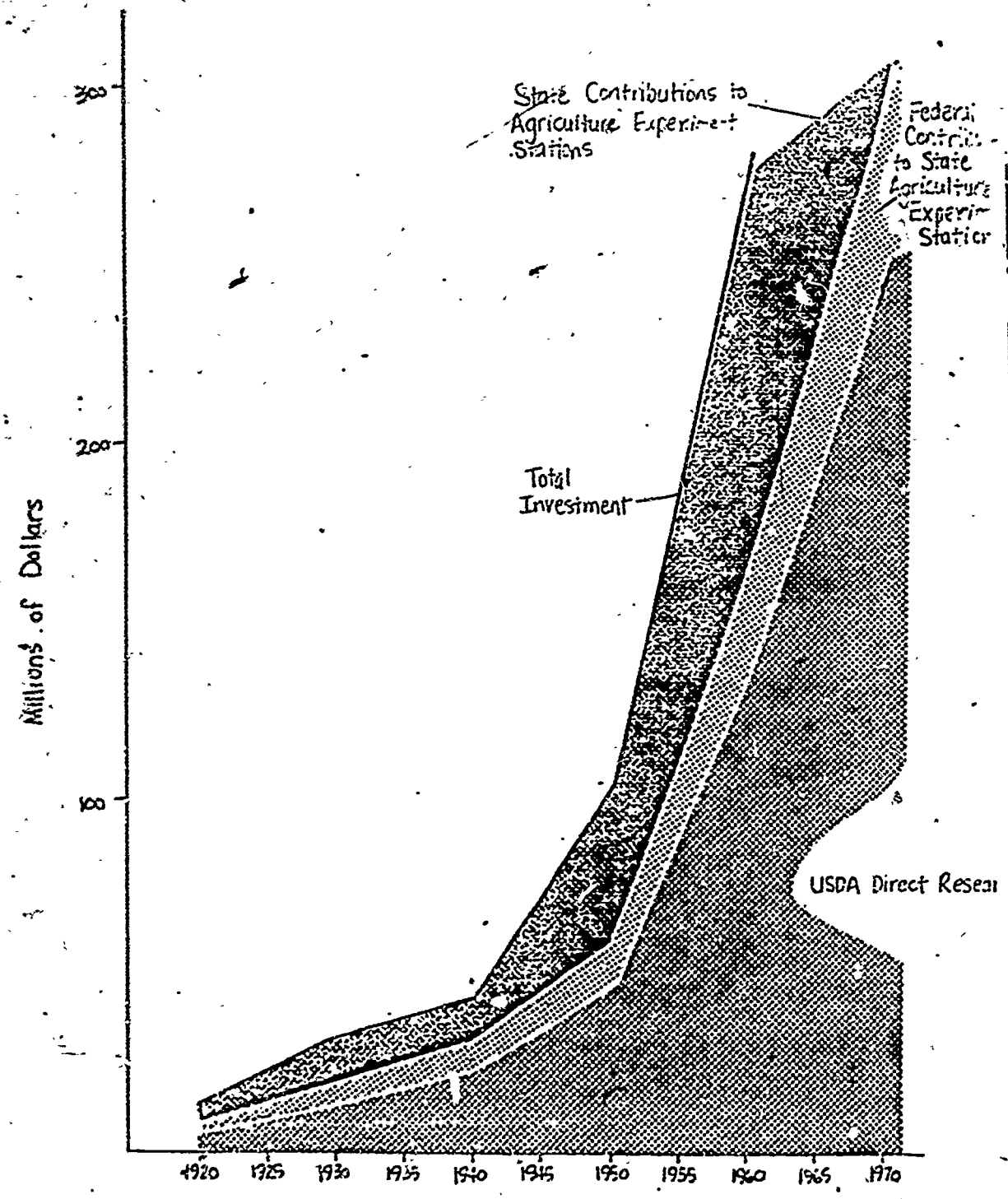


Figure 2. Funds for Public Agricultural Research, 1920-1970.

Source: Sanders (1966).

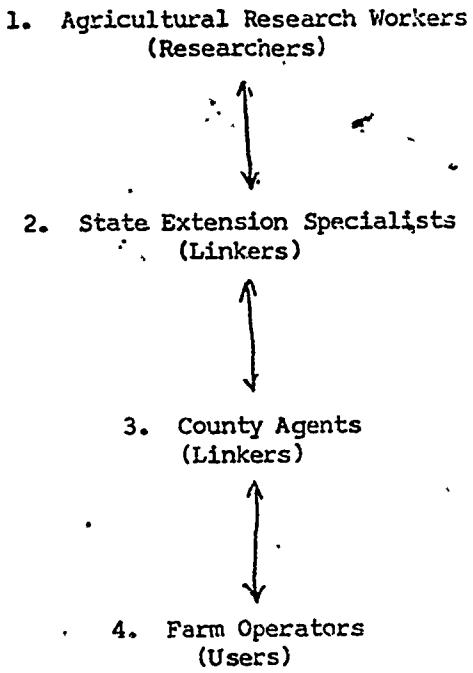


Figure 3. Diagram of the Agricultural Extension Model.

farming, taking over the land of those who could not. In some cases, this land was acquired by corporations, either pre-existing or formed for the purpose, largely because of the superiority of the corporate form of organization in the accumulation of the necessary capital base. Thus the nature of the client group for the extension services began to slowly shift away from the individual entrepreneur and toward gradually increasing numbers of corporate farmers, many of whom had independent access to agricultural technology. In many cases, the local extension agent began to find that the most successful farmers no longer needed him as a conduit for agricultural technology; they preferred to reach directly to the agricultural universities and thus form their own links with researchers.

The county agents, in turn, began to discover other demands for their assistance from rural non-farm people and, ultimately, form urban audiences. As the bounds on their audiences became wider and looser, the nature of the information which they had to dispense became more varied, and the need for the extension specialist as an intermediary between the researcher and the agent became more striking. Specialists in more diverse disciplines were required. The subject-matter of the extension services underwent a radical broadening; the effect was to require a more complicated research and backup system for the county agents.

At the same time, there was no slackening of the demand for further advances in agricultural technology. The strongest demands came, as might be expected from the most articulate and best-organized farmers (partly through their pressure group, the American Farm Bureau Federation).

What these larger farmers demanded was, for the most part, more capital-intensive technology, which offered the highest returns for the capital they had to invest. The effect of this concentration of extension service activities on capital-intensive agriculture was, of course, to leave the poorer farmer even more disadvantaged, since the extension agent did not have much to offer him. This process, in turn, increased the exodus from the farms, and encouraged the increasing concentration of the most productive farming operations in the hands of corporate structures.

At present, the extension agent is a multidimensional conduit for a wide variety of technologies to a wide variety of audiences. His original audience, the independent farmer needing technical expertise, is becoming extinct. The need for change-agentry in its original missionary sense has largely disappeared, at least in relation to the farmer audience, although it remains an extension service preoccupation for the new, poor, urban audiences.

Thus, the agricultural extension services have undergone major changes of focus. Today, there is no one "agricultural extension model"; instead there is a consistent set of assumptions and philosophies about technology generation, transmission, and communication, and a constantly shifting set of administrative arrangements, priorities, and operating systems within this framework. The extension system has displayed remarkable persistence and ability to restructure its relationships as conditions changed, and this adaptability may be its most striking and important aspect.

Table 1 summarizes the main events in the development of the agricultural extension model in the U.S.

Table 1. Highlights in the historical development of the Agricultural Extension Model in the U.S.

Year	Historical Event
1862	Morrill Act establishes a land-grant college in each state.
1887	Hatch Act establishes an agricultural experiment station in each state.
1911	First county agent is sponsored by the Broome County Farm Bureau in Binghamton, New York.
1914	Smith-Lever Act provides federal funds to each state for extension purposes.
1919	The extension services and the American Farm Bureau Federation are separated.
1920	There are about 3,000 extension employees in the U.S.; one agricultural agent for each 2,700 farmers. The position of state extension specialist is established.
1935	Virtually all of the 3,510 U.S. counties have at least one extension agent (mostly in agriculture). The number of county home economics agents begins to increase (to reach almost 4,000 by 1970).
1954	The National Project in Agricultural Communications is launched to retrain extension workers in communication skills.
1955	There are about 2,000 state extension specialists, and the number will increase sharply to 4,000 in 1970.
1969	Expanded Food and Nutrition Program is launched to provide extension aides to reach low-income families in rural and urban areas. By 1973, about 7,600 aides are employed.
1970	There are 15,000 extension employees in the U.S.; 6,300 of these are county-level extension agents; and 4,000 are state extension specialists (most of the remainder are administrators). There is one agricultural agent for each 500 farmers.
1975	The total annual budget of the Cooperative Extension Service is $450 million, with 40 percent from federal funds, 40 percent from state sources, and 20 percent from county governments. Federal funds for agricultural research total about $300 million per year.

We draw nine generalizations from our analysis of the U.S. Cooperative Extension Service.

1. The agricultural extension model has changed considerably since its origin in 1911, in response to alterations in its environment, and these adjustments are one reason for its relative success.

2. The agricultural extension model is based on client participation in identifying local needs (feedforward), program planning, and evaluation and feedback.

3. Agricultural research activities are oriented toward potential utilization of research results, such as through reward systems for researchers, and this pro-utilization policy facilitates the linking function of the extension specialist and the county agent.

4. State-level extension specialists are in close social and and spatial contact with agricultural researchers and university professors in their specialty, and this facilitates their performance in linking research-based knowledge to farmer problems.

5. The agricultural extension model seems to have been more effective in diffusing agricultural production technology to farmers, than in its latter-day extensions to other subject-matter content, and to non-farm audiences.

6. The agricultural extension model now recognized the importance of communication as a basic process-skill of change agents, and provides communication training on an in-service basis.

7. The agricultural extension model includes not only a systematic procedure for the diffusion of innovations from researchers to farmers, but also institutionalized means for orienting research activities toward users' needs through feedforward activities; thus the land-grant college/agricultural experiment station/extension service complex is a total research utilization system, including innovation-diffusion as only one component.

8. If success is measured only by continued growth in size (in funds and personnel), the agricultural extension services have been highly successful due (1) to their ability to adjust to environment changes, and (2) to the strong support of the American Farm Bureau Federation, and of elite farm leaders.

9. The extension services' elitist tendencies have invited criticism for a lack of concern with rural social problems, some of which resulted from the prior activities of the extension services in diffusing technological innovations in agriculture.*

*More specifically, the activities of the extension services over the years have focused rather narrowly on immediate technical problems in agriculture, rather than on the longer-range social, political, economic, and ecological consequences of technological change in U.S. agriculture (Hightower, 1972).

Eight Features of the Agricultural Extension Model

Our review of the development of the Cooperative Extension Service in the U.S. suggests (1) a number of different stages in the development of the system, and (2) a number of consistent features which appear at different stages in different f m. We present here these eight features.

We state these eight main features in the agricultural extension model in general terms so that these elements can be used to analyze other research utilization systems.

1. A "critical mass" of "appropriate" technology, so that the diffusion system has a body of innovations with potential usefulness to practitioners. (By "appropriate", we mean technology with a clear payoff and an understandable connection with previous practice.)

2. A research sub-system oriented to utilization, as a result of the incentives and rewards for researchers, research funding policies, and the personal ideologies of the researchers.

3. A high degree of user control over the research utilization process, as evidenced through client participation in policy determination and attention to user needs in guiding research and extension decisions (this is feedforward), and the importance accorded feedback from clients on the system's effectiveness.

4. Structural linkages among the research utilization system's components, as provided by a shared conception of system, by use of a common "language" by members of the system, and by a common sense of mission. Such internal linkage between researchers and users must continue over time.

5. A high degree of client contact by the linking sub-system, which is facilitated by reasonable agent:client ratios and by a relatively homogeneous client audience.

6. A "spannable" social distance across each interface between components in the system, in which the social distance may reflect levels of professionalism, formal education, technical expertise, and specialization. Generally, these variables decrease in degree as one moves from the research sub-system (where Ph.D.'s are usually employed), through linkers, to the client sub-system.

7. Evolution as a complete system, rather than the research utilization system having been grafted on as an additional component of an existing system. The agricultural research component existed prior to the agricultural extension component, but it had not grown to much size prior to the 1920's.

8. A high degree of control by the system over its enviroment, and thus the system is able to shape the environment rather than passively reacting to changes in this environment. Such a system is less likely to face unexpected crises or competitors, and usually can obtain adequate resources. The degree of control is expressed through the system's power base, its perceived legitimacy, and its amount of political-legal influence.

Lessons Learned About Staging and Phasing in the Development of the Agricultural Extension Model

Table 2 details how the eight features have coexisted at four general stages in the evolution of the Cooperative Extension Service.

Table 2. Main Features of the Agricultural Extension Model Over Time

Main Features in the Agricultural Extension Model	Eras in the Development of the Agricultural Extension Model in the U.S.			
	Pre-Extension (1862-1910)	Institutionalization (1911-about 1925)	Growth (About 1925-about 1955)	Recent (About 1955 to the present)
1. A critical mass of new technology	Little; concentrated in the private sector	Growth of academic research base	Increasing specialization of research fields; start of the "agricultural revolution"	The "agricultural revolution"; federal funds for research reach about $300 million per year
2. A research sub-system oriented to utilization	Dominated by individual entrepreneurs/inventors (e.g., farm machinery inventors)	Utilization focus kept by researchers with farm backgrounds	Development of reward system to encourage research translation into practice	Reward system continues to encourage utilization
3. A high degree of user control over the research utilization system	Farmer control exerted through the market for technology	Rise of Farm Bureaus at the local level	Farm Bureaus federate into a national pressure group, and are replaced as local program planning bodies by county advisory councils	Farmer participation in extension program planning continues
4. Structural linkages among the research utilization system's components	Linkages between land-grant colleges and agricultural experiment stations	County agents form linkage between farmers and researchers	Extension specialist role added to improve linkage between county agents and researchers	Researchers and specialists now linked to agribusiness firms, and through county agents, to non-farm audiences
5. A high degree of client contact by the linking subsystem	Little regularized contact of agricultural experts with farmers	County agents established in almost every county in the U.S. About 2,700 farmers per agricultural agent.	Total number of extension staff triple during 30-year period from 5,000 to 15,000, while number of farmers decrease	Decline in county-level extension staff, while state specialists increase in numbers; about 500 farmers per agricultural extension agent.

Table 2. Continued

ain Features in he Agricultural xtension Model	Eras in the Development of the Agricultural Extension Model in the U.S.			
	Pre-Extension (1862-1910)	Institutionalization (1911-about 1925)	Growth (About 1925-about 1955)	Recent (About 1955 to the prese
. A "spannable" social distance across each interface between components in the system	No effective contact between researchers and farmers	County agents link effectively with their farm audience	Extension specialists added in order to link county agents with researchers	Greater extension effort on non-farm topics and audiences, but with less success than in technica agriculture
. Evolution as a complete system	Little previous agricultural research until land-grant colleges and agricultural experiment stations are established	County agent established as a new linking sub-system	Extension specialists arise as another new part of the extension system	Extension continues alo familiar lines of organ zation, but adds wider scope to program
. A high degree of control by the system over its environment	Land-grant colleges enjoy public support	Involvement of local Farm Bureaus in supporting extension services; county agents have high credibility for farmers	Support for appropriations from AFBF (American Farm Bureau Federation)	Cooperative Extension Service given credit by public for the "agricultural revolution"

Following are our main conclusions about the phasing and staging of the agricultural extension model.

1. A considerable period of time (more than 50 years) was required for the development of the agricultural extension model.

2. Over this period, many very important changes occurred in the agricultural extension model (e.g., the addition of state extension specialists, aides, etc.).

3. The agricultural research sub-system grew in size to parallel with the extension services from 1910 to the present, rather than adding a dissemination system on to an organized body of completed reserach findings in agriculture.

4. Organizational procedures exist and are encouraged for the feedforward sensing of farmers' needs and problems, which provide a relatively rapid turn-around (by providing research-based information to solve these needs), partly through the existing store of already-completed research.

III. Elements of Educational Extension

The Cooperative Extension Service in agriculture has served as a model for R&D delivery systems in many non-agricultural settings, and education is no exception. Two programs in particular have drawn heavily on the agricultural analog: the U.S. Office of Education's "Pilot State Dissemination Project" (1970), and the OE/NIE-sponsored "National Diffusion Network Program" (1974). These experimental programs, together with the existing institutional performers and users of educational R&D, are the building blocks from which an educational RDDF system appears most likely to develop. The purpose of this section is to describe the current status of these foundation elements and to set the stage for a discussion of staging and phasing issues in the further development of an RDDF system for education.

Present Status of the RDDF System

Following the simplified four-level model described in Figure 3, the existing elements of the educational RDDF system can be described as follows.*

1. The R&D Performing Elements

   a. R&D performers: performers of educational R&D include researchers from universities and colleges; nonprofit institutions; state and local governments; profit seeking organizations; and private individuals. Between 1965 and 1974, a rather dramatic shift apparently has taken place among these performers, with the

*Based on data contained in the 1976 Databook.

college and university share of funded research declining from 77 percent to 29 percent, while nonprofit institutes have risen in importance from 10 percent to 54 percent. Between them, these two classes of performers shared 83 percent of all educational R&D funds in 1974. The three remaining performers shared about equally in the balance of the funds.

b. R&D personnel and employment patterns: Unfortunately, statistics on educational R&D manpower have not kept pace with those on institutional performe ; thus it is difficult to tell conclusively whether the dramatic shift in performers noted above has been associated with a change in the type of personnel doing the R&D. NIE reports that in 1965, 64 percent of all educational R&D personnel were employed by colleges and universities; 16 percent were employed by school systems; and the remainder were spread among government agencies, foundations, and miscellaneous other organizations. NIE statistics also show that educational researchers numbered between 8,000 and 12,000 in 1974. These researchers are affiliated with three major professional societies: the American Educational Research Association (AERA); the American Psychological Association (APA); and the American Sociological Association (ASA). When data on participants in in AERA professional meetings and the R&D performing population are compared over time, it appears that the current population of research performers are not as deeply involved in professional associatons as was the case ten years ago. Thus we speculate that the communication of or research results may be shifting away from traditional

"professional" patterns. Whether this apparent shift is real deserves confirmation through research. Additionally, if the shift is real, the question of whether it has been accompanied by an increase in research communications between the "new breed" of performers (i.e., nonprofit research institutes) and the user system deserves careful investigation.

c. Users of educational R&D products: In this analysis, teachers are considered to be the end users of RDDF system products, with students assumed to be the ultimate beneficiaries. This is in keeping with the agricultural extension system analog, where farmers are considered the end users of innovations developed through agricultural R&D. NIE reports that the 1975 user population consisted of 2,308,000 individual instructors working in 106,797 schools which were administratively organized into 17,238 school districts. The trend for many years has been toward consolidation of school districts in an effort to increase administrative efficiency and cost-effectiveness. According to NIE, only 300 to 350 of the nation's 17,238 school districts maintain R&D offices, and only 16 percent of the 1965 professional R&D researcher population was employed by school districts. Similarly, in 1974, researchers employed by local school systems participated in fewer than 7 percent of the professional events at AERA conferences and conventions. While lack of travel funds and/or released time could limit such participation, nevertheless it seems clear that the educational research performers have

limited contact with RDDF users. The ratio of potential users to total R&D performers is roughly 200:1. The ratio of potential users to readily accessible R&D performers (i.e., those employed by LEA's) is roughly 1,400:1. More interestingly, since only about 350 of the approximately 17,000 school districts maintain R&D offices, it appears that users in 95 percent of the nation's school districts have no opportunity for very direct contact with educational R&D performers.

It is obvious, then, that the R&D feedforward function in the current RDDF system (as regards the perceived needs of teachers) is heavily dependent on indirect linkages between users and R&D performers. The R&D dissemination and utilization (reduction of research results to practice) is similarly dependent on indirect linkages. Thus, a further examination of the indirect linkages between R&D performers and users is fundamental to understanding possibilities for further evolution of the system.

One additional characteristic of the RDDF user population seems important in light of the limited contacts between R&D users and performers. In those few cases where R&D performers are located within LEA's, it appears that they are administratively attached to district level R&D offices, and thus may be accessible to teachers primarily through the district superintendent's office. It has been our observation, however, that teachers find few opportunities or excuses to interact with district-level staff personnel with the openness and regularity needed to foster innovation. Additionally, research by Carlson (1965) has shown

that the attitudes and behavior of key administartors are important influences on the adoption of research-based innovations by teachers. Moreover, secondary teachers are usually specialized by subject matter, while primary teachers often are not. These observations suggest that, as in the agricultural extension system, specialized researcher-user-intermediaries may be required at the LEA level to promote RDDF effectiveness. The agricultural extension service, by using agents specialized in 4-H club work, home economics, and various subfields of agriculture, has been effective in minimizing the social distance between potential users and "agents," thus enhancing system utilization.

Several other characteristics of the teacher/user are notable for our purposes. One is that his (or her) R&D information environment if very diffuse. NIE has noted that educational R&D has no dominant journal, and instead reports research results in more than 2,000 periodicals. Readership patterns among teachers are not known to us at this writing, but they would be helpful to know. It appears to us that an important information channel to teachers regarding innovations is in-service training programs and other release-time activities. However, House (1974) found that teachers often fail to follow through in the classroom on innovations which they were "sold on" in special training programs or demonstrations. We have previously noted that educational R&D conferences and professional meetings are seldom attended by LEA employees. Similarly, we presume that teacher conferences may

also be sparsely attended by researchers. Thus, it appears that R&D products are delivered to teachers primarily as new or revised curriculum packages embodied in materials published by commercial firms.

Finally, it is clear that the reward structure for teachers is substantially different from that affecting farmers. The independent farmer seeks to raise profitable crops and animals in an environment with a large random element affecting his success. He has historically fought to reduce his vulnerability to weather conditions of over-production by forming cooperatives to control supplies and prices, and by lobbying for government price supports. His rewards are largely economic. The teacher also has economic goals, such as job security and protection against salary erosion, and sometimes affiliates with unions to attain such goals. But teachers undoubtedly obtain other satisfactions from their work which might make economic rewards of secondary importance, perhaps even more so in the current period when two-income families are common. It may thus be very important to investigate the strength of the commitments of teachers to the activities of their job-related professional associations and unions before assuming that such organizations could do for the educational RDDF what the Farm Bureaus did for the agricultural extension service.

In summary, teachers need to be viewed as the adopters and users of RDDF system products, but also as important sources of ideas and information about educational R&D "needs" at the

classroom level. Opportunities for direct interaction between R&D performers and teachers are few. The adaptation of R&D products to classroom environments has been largely to chance until recently.* Aggregate-level indicators of the "health" of the educational enterprise, such as standardized test scores, college performance, etc., need to be linked to teaching/learning activities in the classroom. Thus a central challenge in the educational RDDF system's evolution is understanding the role of the teacher in the innovation process, and providing reward structures for effective interaction among teachers, R&D performers and the linking elements in the system.

2. Linking Elements

Two types of linkage systems appear to be important to the success of an educational RDDF system: administrative linkages among the hierachy of agencies which provide sponsorship and political support for the system; and functional linkages among the users and performers of educational R&D. Presumably, the administrative hierachy should provide the sponsorship and resources needed to establish and maintain the functional elements in the system.

a. Hierarchical linkages: Sponsorship of educational R&D rests heavily with the federal government, which provided an estimated $470 million of R&D funds in FY '75.** State governments provided

*NIE reports an emerging trend toward the development of complete educational "packages" by some R&D performers.

**Based on OMB estimates; see NIE 1976 Databook.

an estimated $40 million, while local government agencies provided $4 million. Interestingly, while private foundations unlike government agencies, have no legal responsibility for education, they provided an estimated $57 million for R&D in FY '75. Thus, private foundations contributed more than state and local governments combined. Not-for-profit research institutes provided between $3 million and $25 million of additional R&D funds in FY '75.

It is difficult to determine what proportion of educational R&D expenditures are in support of research versus supporting the elements of the linking system. NSF figures, which do not purport to include the funding of dissemination and utilization activities, show total federal obligations of $157.8 million in FY '75. OMB figures, which include experimental and demonstration projects and dissemination and evaluation activities, were $429.8 million in FY '75. It is difficult to precisely interpret the differences between these two figures. Clearly, they suggest that the federal government is supporting the dissemination and utilization functions at a substantial level, and that the state and local share is considerably less.

For comparison purposes, it is noteworthy that in FY '75, federal agricultural research expenditures were $300 million, and the Cooperative Extension Service cost an additional $450 million, of which 40 percent came from federal sources, 40 percent from state sources and 20 percent from local sources. Thus it appears

that the cooperative features of the agricultural extension system have resulted in a greater sharing of the costs of the delivery system than is the case in education.

Political constituencies, particularly the Farm Bureaus, which coalesced to transcend the federal-state-local hierarchy, were important elements in the evolution of the Cooperative Extension Service. In education, it appears that such groups as the School Study Councils represent potentially important sources of political support for extension activities at the local level. Whether their interests extend to lobbying for needed legislation and earmarked funds at the state and federal levels remains an open question.

b. Functional linkages: Federally-supported institutions in the RDDF linking system include 13 R&D centers, 8 educational laboratories, and the 16 ERIC clearinghouses. These regional institutions are designed to provide a nationwide base for the performance of educational R&D, the testing and evaluation of R&D products, and the dissemination of research results. State level R&D funding is apparently much lower than at the federal level. State support for the RDDF infrastructure included the maintenance of 146 General Educational Information Centers in 36 states; 53 Special Educational Information Centers in 31 states; 208 teacher centers in 38 states; and 339 educational libraries at colleges and universities in all 50 states. Additionally, the aforementioned School Study Councils, pioneered by Professor Paul Mort, currently number 70 across 30 states.

NIE further reports that 29 of the 38 states which have formal educational RDD&E functions receive R&D funds from the federal government for development, demonstration, dissemination, and evaluation functions. Such funds may be further allocated on a formula basis to some of the 350 local school districts in the nation which maintain R&D offices.

As noted earlier, few R&D performers have frequent, "in-situ" contact with teachers. Thus, linking persons as well as linking institutions in the educational RDDE are important features to be developed. Two major efforts have been made in recent years to experiment with educational linking agents at the local school district level. These two experiments, the Office of Education's Pilot State Dissemination Project, and the OE/NIE National Diffusion Network Program, are discussed in detail in the following sections.

Education is very decentralized in the U.S., with much innovation decision-making at the level of the local school district or in the state department of education. Agricultural research and extension is also very decentralized to the local and state level; climatic and soil conditions, which are related to agricultural production, are very heterogeneous from state to state, and even from country to country. Educators believe that school children, schools, and communities are very heterogeneous, and if they are correct, the educational RDDF system may also need to be decentralized in nature.

THE U.S. OFFICE OF EDUCATION PILOT PROJECT WITH EDUCATIONAL EXTENSION AGENTS

The U.S. Office of Education (OE), until the late 1950's, was a very small group of subject-matter specialists, administering a few small programs of assistance to state education agencies (SEA's) for limited purposes. The National Defense Education Act of 1958 marked the beginning of the growth of OE into a major organization, but it was not until the Elementary and Secondary Education Act of 1964 (ESEA) that the real spurt occurred. In two years OE quadrupled in size, and took over a whole new range of functions and powers of regulation and control in education.

Title IV of the ESEA created a new program of education research grants, and the OE reorganization of 1965 set up a Bureau of Research (BR) to administer this activity; it contained divisions of elementary education research, higher education research, vocational education research--in short, it was to serve as the research arm of the other component bureaus of OE, which accordingly had no research programs of their own. The suddenness of the growth of these research activities, and the creation of BR, did not allow OE to develop a fully rational plan for the effective utilization of its research funds. Instead, for several years BR was content to fund the proposals that were received, since there were few resource constraints. By the late 1960's, with the beginning of federal funding cutbacks, BR moved to a "centers of excellence" concept, creating a set of R & D centers and 20 "regional educational laboratories" to orient research activities toward developing educational innovations. However, there was still no utilization plan, and relatively little monitoring to see what use was being made of the centers so created.

One of the activities emerging from this period of retrenchment in the research function was a computer-based research cataloging system called "Educational Resources Information Center" (ERIC). Patterned on successful systems such as the National Library of Medicine, ERIC is an information system that was expected to amass research results in order to expedite searches by users. ERIC was essentially a passive resource, but it represented a step toward applying research results to particular problems;

A useful review of the various research-to-practice linkage systems in the field of U.S. education is Butler-Paisley and Paisley (1975).

at least it facilitated determining which areas and topics had been studied. The ERIC system was implemented through a series of 17 clearinghouses throughout the country, and was centrally managed by BR's Division of Educational Technology. Today there are 16 ERIC clearinghouses with federal support totalling about $3 to $5 million annually.

As BR's efforts began to be more closely scrutinized on utilization criteria in a period of declining resources, attention turned increasingly to ERIC, one of the most solid products of the whole educational research effort. While it was a resource of unquestioned value, it was clear that it was not being tapped to anywhere near the degree that it might be. The cost, effort, and skills necessary for teachers to use ERIC simply was greater than they could afford. An evaluation survey of ERIC users in 1970 by Frey (1972) found that 62 percent of the users were college students. Only 21 percent of the users were teachers.

In 1970, the reorganization of OE broke up the old Bureau of Research, and ERIC became part of the new National Center for Education Communication. NCEC determined that a concentrated effort to increase the use of research resources should be tested, and accordingly began the "Pilot State Dissemination Project" in 1970, based explicitly on the agricultural extension model, even to the name "educational extension agents." From the beginning, the main thrust of this approach was to increase the utilization of ERIC.

The pilot project was fairly small-scale, limited to seven areas in three states. Each area had a full-time "educational extension agent" assigned to it, who visited the schools in the area (consisting of one or more school districts) to find teachers who had problems about which there might be research solutions. In each of the three state education agencies, there was an information retrieval specialist (or group) who took the requests brought in by the extension agents and searched the resource bank (primarily ERIC) for appropriate references. When such information was identified, the agent would convey it to the requestor. The agents also played a variety of consultative roles, depending on their particular expertise. The most significant part of the experiment, however, was the use of the educational extension agents as intermediaries between ERIC and the potential users (mainly teachers). Care was given to avoid setting up an "expertise gap" between users and the information system.* Further,

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* In fact, Sieber (1973b) concludes that a crucial factor in the acceptance e educational extension agents was their similarity in subject knowledge rganizational rank with their teacher-clients.

the agent/client ratio was reasonable, with about five to ten school buildings and 100 to 200 teachers per agent.

The role of the educational extension agent was largely developed by the individual occupying the position, and each of the seven agents operated somewhat differently. The OE agents were not directly a part of the organization to which their services were being rendered; the OE "clients" were teachers and school administrators, while the educational extension agents were identified as personnel employed by the state education agency. The educational extension agents' "authority" was thus consultive, and demanded a rather astute mixture of rational problem-solving and interpersonal relations to build appropriate working connections with the schools and teachers with whom they worked. What was needed was a degree of informal manipulation of the power structures in the local school systems; most of the agents became very adept at this ability during the pilot project. This lack of official power was a positive factor in increasing the acceptance of the agents' service; not only were certain intraorganizational dynamics avoided, but the agents had to "try harder," rather than relying on the system to see them through. The right of the client to define his needs and choose his solutions meant that the educational extension agent was not held responsible if he provided "bad information," and this needs-orientation was an important factor in the teachers' acceptance of the extension agents (Sieber, 1973b).

The Office of Education sponsored a full-scale evaluation of the project while it was underway (through the Bureau of Applied Social Research at Columbia University). The evaluation in the OE pilot project was generally positive, indicating that the presence of the agents in the target areas had indeed led to a much greater utilization of ERIC than existed in non-target areas, and that the results of the service were generally satisfactory to the teacher recipients (Sieber, 1973a and 1973b; Sieber and Louis, 1973; Sieber et al., 1972).*

A number of specific guidelines for a larger-scale program emerged from the evaluation, particularly in terms of administrative and support

*One federal official who was involved with this program suggests that the evaluations may have been less critical than deserved due to modest initial expectations about program accomplishments.

arrangements. However, several key questions about the reasons for variations in utilization rates remained a mystery and resulted in uncertainty and debate about the likely success of an expanded version of the educational extension program. Because of this uncertainty, plans for a national expansion of educational extension agents, which were developed late in 1971, were finally shelved. A plan for a more modest experimental expansion of the system was developed in order to resolve key questions underlying the debate over its potential success as a national program. This experimental program was never implemented, apparently because of loss of key agency personnel and shifting agency priorities.

The strategy at HEW in 1971 called for services such as dissemination to be developed and financed by state education agencies through revenue-sharing and other mechanisms, rather than through federal project grant funds. The experience with revenue-sharing to date, however, does not indicate that innovative programs such as an extension network are often supported by these funds. State agencies apparently are hard-pressed by competing demands for revenue-sharing funds from established programs. Until 1974, the notion of a national educational dissemination system remained a good idea whose time had not yet come. We shall describe, in the following section, the National Diffusion Network Program that eventually emerged in 1974, and show how it built upon some of the experiences in the earlier attempt at educational extension.

The educational extension agents were oriented to respond to user needs. In fact, one evaluator's criticisms of the educational extension agent program was that it remained almost exclusively responsive, and made little effort to "diagnose" problems and to help actively in the definition of needs. This shortcoming occurred in spite of the fact that the OE pilot program began with an "increase-the-use-of-ERIC" motivation. By operating in this responsive mode, the OE extension agents enjoyed a high level of acceptance with their clients.

Several observers, including those who conducted the formal evaluations, commented that a major departure of the educational extension agent program from the traditional agricultural extension model is that the potential "adopters" of the research results were in the educational case located in organizational rather than individual settings. Teachers are organized in schools, while farmers act mainly as individuals. Thus

organizational dynamics enter into the educational adoption decisions, as well as individual criteria. While this organizational aspect was involved to a degree, the educational extension agents operated in a climate fairly close to that of the agricultural extension model. Many research findings in education can be utilized effectively by an individual teacher; relatively few needs which surfaced through a mechanism such as the educational extension agents required system-wide action to implement an innovation.

In a peculiar sense, the lack of clear research planning in the original educational research effort may have made it easier to utilize the results. Leaving the topics to be researched primarily to the interests of the researchers led to considerable concentration on individual classroom experimentation, rather than the more difficult school system-level analysis. As we have seen, it is primarily for this classroom-oriented research that most opportunities for utilization exist. Thus the body of research with which the educational extension agents had to deal was at the outset fairly usable and relevant to the potential adopters.

In the case of educational research where the parallels with the agricultural situation are not stretched too thinly, the use of the agricultural extension model provided an alleviation of some of the more serious difficulties in research utilization. The Office of Education did not quite grasp the total scope of the agricultural extension model; they only implemented a system to diffuse existing innovations (based on prior research) to users, but failed to establish a research utilization system that also included means by which users' needs could be translated into research problems through feedforward activities. To make a metaphor, OE established an extension service, but not the other components of the land grant college/agricultural experiment station/extension service complex. Perhaps the OE attempt at extending the agricultural extension model would have been relatively more successful if they had implemented the entire research utilization complex, instead of merely the innovation-diffusion component. But such a broader scope would have involved much greater costs and necessitated major restructuring of the organization, without any guarantee of additional success.

NATIONAL DIFFUSION NETWORK PROGRAM

A different approach to the diffusion of education innovations was begun by the U.S. Office of Education, with some minimum assistance from the National Institute of Education (NIE) in 1974.* It is called the "National Diffusion Network Program" (NDN), and represents several important changes and modifications from (1) the agricultural extension model, and (2) the educational extension agent pilot project of the early 1970's, which directly influenced the diffusion strategies followed by the National Diffusion Network Program. The most important of these strategies are:

1. The source of educational innovations are developer/demonstrators (D/D's), local schools or school teachers that invent and develop a new idea, perhaps with some assistance from technical experts like college professors, R & D laboratories, or commercial suppliers. In order to become a D/D, a description of the innovation (that has been developed by the potential D/D is submitted, along with evaluative evidence of the innovation's relative advantage, to an expert committee in Washington called the Joint Dissemination Review Panel (JDRP), composed of OE and NIE staff. Once approved by this committee, the innovation is considered a "validated practice." In July 1974, when the National Diffusion Network Program was launched, 34 D/D's were approved and funded; six more were added in 1974-75; and 36 more in 1975, making a total of 73 validated and OE-funded innovations. In addition, 50 or more other innovations (and D/D's) were approved, but not funded by OE.

Obviously, the emphasis on local schools as inventors/developers in the National Diffusion Network Program reflected a shift in OE thinking away from expert R & D sources of educational innovations,** and recognized the greater credibility attached to a D/D's innovation by other school personnel in the target audience. Also, the relatively large number of innovations included in the program (73 funded; about 120 that were validated), and their

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*NIE was created in 1972 with a goal of reforming educational practice in the U.S. (Clark and Guba, 1974). At the same time, however, OE also continued with its dissemination activities.

**Although in mid-1975, the Far West Laboratory for Educational Research and Development was connected to the NDN Program in order to offer certain technical assistance.

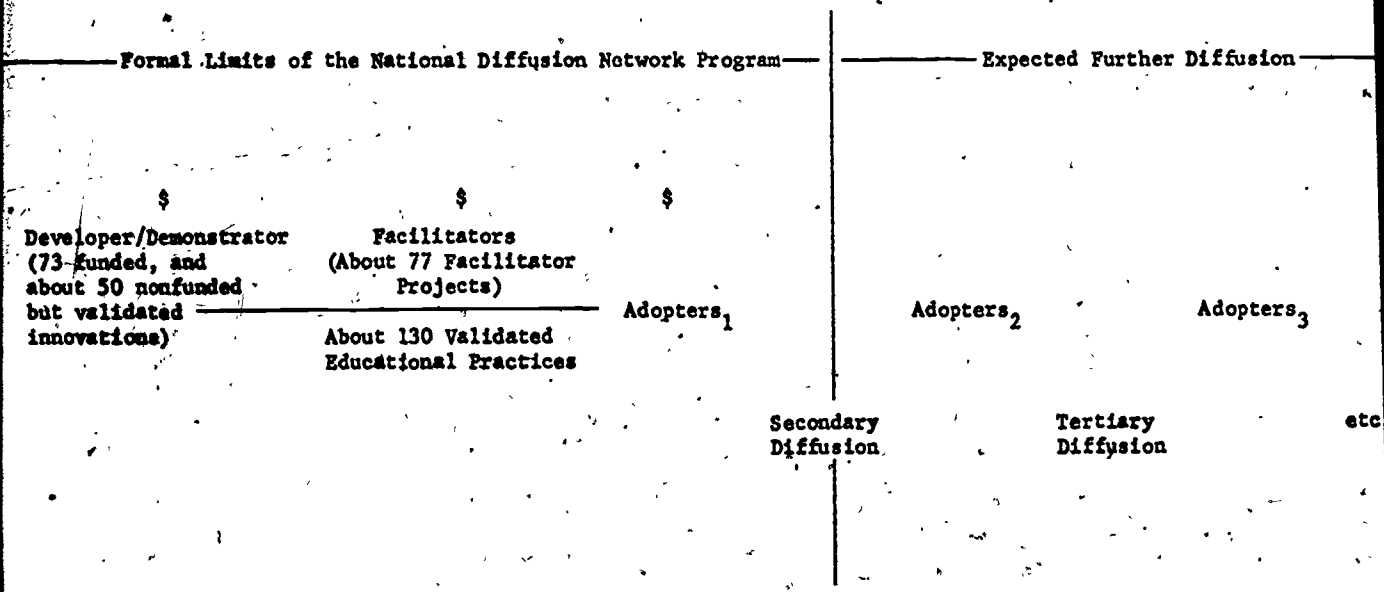
wide variety, implied an abandonment of the previous assumption in the field of education that certain "standard" innovations (like team teaching, programmed instruction, teacher aides, videotape cassettes, etc.) could each be promoted to all public schools. Most of the 73 innovations, in fact, are appropriately applicable only to certain schools that have certain common problems.

The main focus on the bottom-up development of innovations in the NDN approach is made workable by the role of the Joint Dissemination Review Panel, which screens out inappropriate educational innovations from the diffusion network. Thus technical expertise is still brought to bear at a point where it can be most useful (in innovation screening), even though such R & D expertise plays only a minor role in creating the educational innovations (by the D/D's). In fact, the 120 validated practices were selected out of about 300 submitted to the JDRP.

The chairman of the JDRP, a Deputy Commissioner of OE, stated: "In the past it was enough to say a program was effective if someone visited it and came back saying, 'The parents love it; the kids love it; and I saw it and it looked good'" (Neill, 1976). This official feels that school personnel now demand "hard" evidence that an innovation can be advantageous if replicated in another site, that changes in cognitive scores or in attitudes claimed for the innovation are not due to the Hawthorne Effect, or to a particular setting and a particular teacher. Further, JDRP requires that each potential D/D provide cost data so that a future adopter can know approximately what resources will be necessary for materials, training, and additional staff if the innovation is adopted.

2. When a D/D's innovation is validated, the D/D may be provided with federal funds by OE to provide training about the innovation to potential adopters, to produce brochures and other mass media messages about the innovation, and, generally, to become a demonstrator for the innovation (hence the title "developer/demonstrator"). Potential adopters can visit the D/D to observe the innovation in use and to discuss it with D/D staff, who, as might be expected, often display a missionary enthusiasm for their innovation. The D/D staff may even demonstrate the innovation at the potential adopter's site, or at a third site.

3. As Figure 4 shows, "facilitators" are provided to link the D/D's with "adopters." The facilitators are the equivalent of the county extension agent in the agricultural extension model, and of the educational



PARADIGM OF THE OE's NATIONAL DIFFUSION NETWORK

FIGURE 4

extension agent in OE's educational dissemination pilot project in the early 1970's. The facilitators were federally funded in 1974 through OE grants to about 77 projects, each with a staff of from one to ten facilitators who were responsible for linking the 73 D/D's with potential adopters in all or part of a state.* These facilitator projects were mostly funded for the one-year period to June 1975 (with the possibility of further funding on the basis of their demonstrated effectiveness). The responsibilities of the facilitators include (1) assisting the D/D's in their area, (2) identifying adopters that represent a range of local school conditions (such as rural, suburban, and urban communities), for which one of the 73 validated practices are applicable, and (3) assisting such adopters in their area in becoming aware of the innovation, visiting the D/D, receiving training about the innovation, adopting it, and diffusing it to other adopters. The facilitator has a rather hopeless client ratio (for example, the facilitator project in the state of Michigan serves about 117,000 public school teaching personnel), but this ratio becomes more realistic because (1) the facilitator only works with the 73 funded innovations, and the 50 non-funded but validated innovations, (2) among a modest number of identified adopters, and (3) the facilitator is assisted by the D/D's staffs in diffusion activities.

4. Some adopters (see Figure 4) sign an "adoption agreement" with their facilitator (about two-thirds do not), indicating their intention to adopt the validated practice. Occasionally the adopter is provided with funds from OE through their facilitator to offset travel costs for the adopter to travel to the D/D to observe the innovation, to purchase release time in order to receive training about the innovation, and/or to purchase materials required to adopt and implement the innovation.** As of September 1, 1975, there were an estimated 1,000 formal adoption agreements, and upwards of 2,000 adopters.*** Obviously, as Figure 4 indicates, a secondary diffusion

*The 77 facilitator projects were located in 36 states by the end of 1975; in the remaining 14 states, SEA's were provided some federal funds under a separate ESEA authorization to carry out certain of the facilitator activities. The number of facilitator projects decreased to 60 in 1976-77 due to changes in funding and in OE policies.

**Actually, the direct funding of the Adopters$_1$ was discontinued in 1975, and some facilitators then provided limited financial assistance.

***An adopter is defined as a local school that has learned about an innovation (by seeing a demonstration, undergoing training, etc.), implemented it in the school system, and expressed an intention to continue using the innovation for a reasonable period.

from the Adopters$_1$ schools is expected, a tertiary diffusion from the Adopters$_2$, etc. The exact extent of such secondary and tertiary diffusion has not yet been determined, and it is still rather early for such further diffusion to have occurred at the present writing. "Adopter incentives" are provided only to the Adopters$_1$, thus ensuring that most schools do not adopt the innovations unless they are perceived as appropriate to their own felt needs (Clark and Guba, 1974).

5. A considerable degree of re-invention and modification of the D/D's innovations is encouraged on the part of the Adopters$_1$ as they fit the innovation to their actual school conditions. In some cases, it has been noted that the Adopter$_1$ may re-label the D/D's innovation, even when its form has not been modified to any considerable degree, suggesting that the Adopter$_1$ may be motivated to give the appearance of modification for psychological, egoistic, or socio-political reasons.

6. The National Diffusion Network Program, as shown previously, emphasizes training of the adopters about the innovation and providing in-person, on-site assistance as important mechanisms of diffusion. To this extent, there is a parallel to the early agricultural extension work by county agents.

7. The Program also is nationwide in scope (as indicated by its name), rather than only being a pilot project of seven educational extension agents in three states, like its predecessor of the 1970's. And the funding of the NDN is considerable, about $16 million during its first two years of operation. Significantly, in states with facilitators, state educational agencies (SEA's) play a relatively minor role in the NDN Program. Some of these SEA's may, by means of a 1975-initiated NIE program of "state capacity-building" grants, become broadly involved in other dissemination activities.

8. The NDN Program, as its name also indicates, emphasizes formation of a communication network among peers that links the D/D's and Adopters$_1$ with assistance from the facilitators. Such a network approach implies that the facilitator is at least partly freed from a major responsibility for expertise about the 73 innovations; the facilitator is thus mainly in charge of building the network of peers, and allowing it to diffuse the educational innovations.

At present, it is too early to draw any conclusions about the relative success of the NDN Program. An OE contract was awarded in mid-1975 to the

Stanford Research Institute for evaluation of the Program, and the results to date suggest that the NDN was at least a modest success.*

In any event, the NDN Program represents an ingenious attempt by the OE to modify the agricultural extension model to the particular organizational conditions of U.S. education. The degree of modification of this model is much greater than in the educational extension agent program that preceded the NDN program.

The NDN Program is, as its name implies, a network linkage system for research utilization, one that seeks to connect the producers and users of educational innovations (ERIC and the School Study Councils** also are illustrative of this network linkage approach). In the relatively few years since its initiation in 1974, NDN has done little feedforward need-sensing for educational research. Through their direct contacts with teachers and school administrators, the 60 state facilitators could have performed this feedforward function, but to date they have not.

Table 3 provides a comparison of certain aspects of the agricultural extension model with the extension of educational innovations.

Summary

We conclude that attempts to introduce one or two elements of the agricultural extension model to non-agricultural settings can be viewed as interventionist acts which should not be undertaken without adequate appreciation of the difficulties of social interpretation. Time and resources required to permit these new functions to prove their utility and to become assimilated into the culture of the host system may be easily underestimated. Agricultural extension evolved and developed its

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*The final report by Dr. John Emrich and his colleagues at the Stanford Research Institute has been reviewed by the present authors, and is to be published in mid-1977.

**There are presently about 70 of these School Study Councils in the U.S.; each is mainly intended to facilitate the exchange of information about educational innovations among the member schools. The late Professor Paul Mort at the Columbia University Teachers College was instrumental in founding these councils and, in fact, these councils provided most of the funding for the educational diffusion studies by Mort and his students in the 1940's and 1950's. There is a direct parallel to the School Study Councils in the "agricultural improvement councils," whose members were mainly gentlemen farmers, and who today sponsor most of the county and state agricultural fairs.

Table 3. Extension of the Agricultural Extension Model to Education.

Aspects of the Agricultural Extension Model	Extension and Application to Educational Innovations
1. Locus of adoption decision	
Individual decides to adopt or reject an innovation.	Systems or organizations (like schools) often collectively decide to adopt or reject innovation(s).
2. Source of innovations	
Most of the innovations are developed at R & D laboratories.	Most innovations come from universities, regional laboratories, and commercial suppliers, but some new ideas are developed by practitioners.
3. Who benefits by the innovation	
Payoffs and gains are relatively early, visible, and acquired by the adopter.	Payoffs and gains often take a great deal of time (there is a lapse between use and results).
4. Nature of the innovations	
Technologies and their consequences are clearly understood by the adopters.	The innovations are often non-material, and their consequences are complex and may not be very clearly comprehended by the adopters.
5. Direction of communication flows	
Most of the information about innovations is top-down and one-sided, but it is presumably provided in answer to needs.	Communication flows are becoming more interactive, especially in the National Diffusion Network approach.
6. Implementation	
Clear-cut implementation of the innovation occurs.	Often unclear as to when implementation has occurred because innovations may be vague and general in nature.
7. Client/change agent ratio	
One change agent per 500-1,000 farmer-clients, but many are reached only indirectly.	One change agent may be assigned to serve a large number of clients, but in reality he/she can only work directly with a small number.

elaborate role structure and functions over a long period of time. Extension specialists emerged because of the increasing complexity and specialization within agricultural research, a situation to which county agents could not respond without diminishing their direct contacts with farmers, and thus reducing their effectiveness. Extension specialists thus emerged to fill this recognizable need, a need which was backed up by powerful supporters of the agricultural extension system who could deliver the votes and the resources to make this adaptation possible. These observations, together with the known failure of modestly-funded efforts to transplant specific elements of the agricultural extension model into other sectors, suggest that an extension system approach, rather than a "county agent" approach, needs to be taken, and that a first consideration in defining the elements required for successful implementation is the identification of a relatively homogeneous client group which can be contacted directly by technically competent and trustworthy agents on a systematic basis.

The agricultural extension services begin with users' needs and problems, and the system operates to find useful information to meet these needs, while the OE activities illustrate an opposite approach of conducting research largely in answer to researchers' needs, and then attempting to find some use for the results. Naturally, the research topics usually do not match up with users' needs. An effective research utilization system must begin with users' needs, which are monitored through feedforward activities.

The U.S. Office of Education did not grasp the full scope of the

agricultural extension model, as they perceived it as only an innovation-diffusion system rather than a complete research utilization system. In other words, these federal agencies ignored the fact that the extension services are only one component in the land grant university/agricultural experiment station/extension service complex.

One main difference between the agricultural extension model and the educational (and other) programs that followed the model are not just that potential adopters are nested in organizational settings, but that the nature of the innovations to be adopted implies that an individual cannot adopt without carrying the rest of the organization along with him.

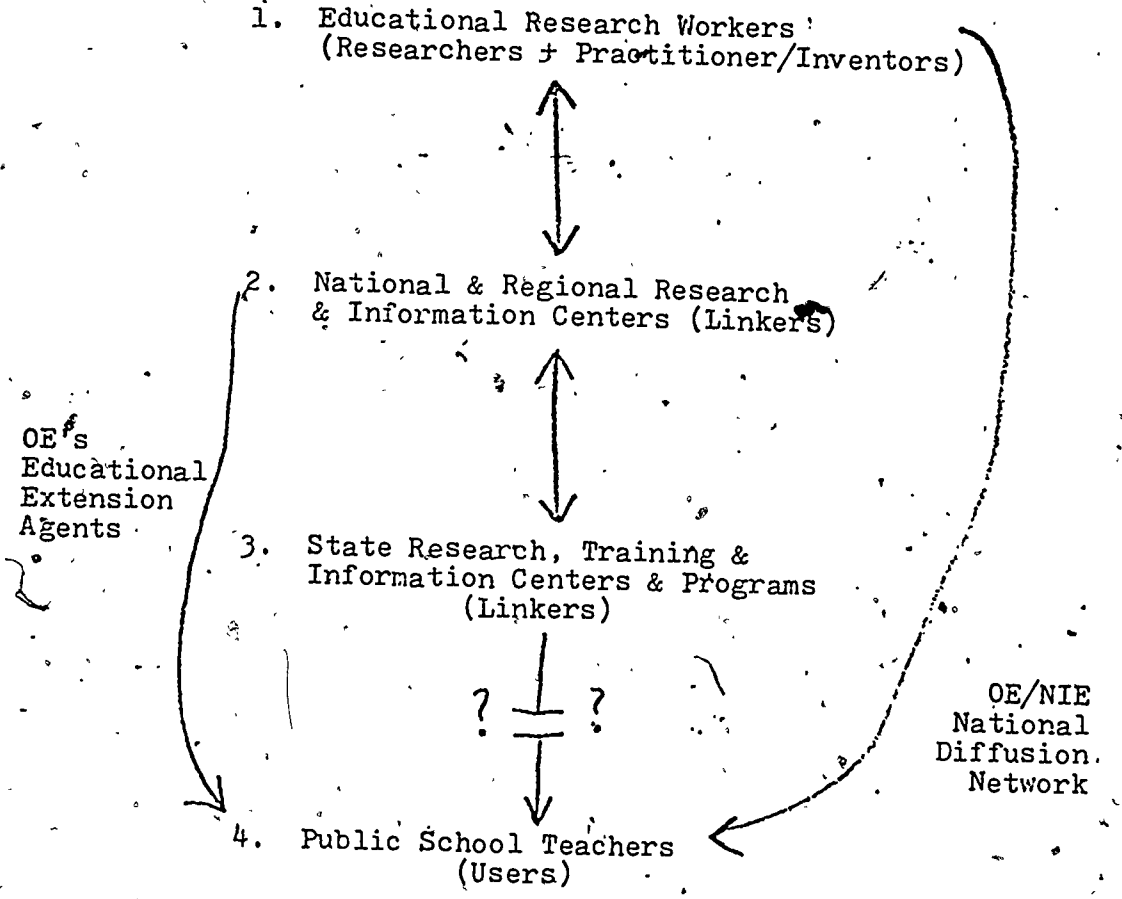
The relative success of the extensions of the agricultural extension model is due to extensive modification of the model to fit its new application.

IV. Staging and Phasing Issues in an RDDF System for Education

It should be clear from the foregoing that the present educational system for innovation differs in many respects from that in agriculture. It differs structurally, with the educational RDDF system appearing "top-heavy" in the number and nature of its national and regional centers. The Cooperative Extension Service is an integrated system with the bulk of its facilities, personnel and decision-making authority residing at the state and local level. They differ in maturity and in pattern of development. The agricultural extension system is 66 years old, and it has developed in an evolutionary pattern, with close linkages to users leading the process, and evolution of the research components and the bureacratic structure following. The Cooperative Extension Service developed out of user needs coupled to highly visible economic consequences and was spurred by political activism among powerful elite sponsors of the county agent idea. Because of the potential economic gains to be made from county agentry, an element of market competition was present to help stimulate the widespread diffusion of the approach.

The educational system is at a pre-extension state of development (see Table 2), lacking the systematic connection between the performers and users which the county agent provided in agriculture from 1911 forward. On the other hand, education is as advanced, if not more so, than agriculture in the R&D performing and information storage/retrieval aspects of the system (see Figure 5). From our perspective, there is little doubt that the potential for rapid advances in the development of an integrated RDDF system for education lie in the addition of improved coupling elements

Figure 5. Elements of the educational RDDF system.



at the LEA and SEA level, and in the development of a sponsoring system for such activity. The following section describes the basis for this interpretation.

Agricultural and Educational Extension: Comparison of Key Features

In Table 4, the key features of the agricultural extension service are compared to those of the extension efforts in education, as represented by the OE's Pilot State Dissemination Project, and its National Diffusion Network Program. A quick comparison suggests that OE's experimental efforts, taken collectively, have covered the same ground in all but two areas: educational RDDP is not evolving as a complete system; and it is (consequently) not able to exercise the degree of control over its environment that may be required for full development. Thus, while the Farm Bureaus lobbied for support at the county, state and federal levels as the agricultural extension system evolved from a local to a national organization, the educational scene is quite different. Many of the elements and institutions needed for the creation, storage and retrieval of educational R & D products exist at the national, regional and state levels, but little support exists at the LEA level to facilitate extensive, routine contact between the teacher and other elements of the syste. With the exception of the facilitator role created by the National Diffusion Network Program, the counterpart of the county agent is seemingly absent from the education scene. However, the apparent "modest success" of the NDN Program suggests that close working relations can be established at this level. Secondly, the NDN Program illustrates that "invention" does occur at the LEA level in response to perceived educational needs and that "inventors" are interested in seeing their ideas applied, adapted and widely diffused.* However, it is also true that the NDN Program, while providing for "screening" of locally

*Whether such interest on the part of inventors is temporary or continuing may depend, in part, on the reward structure associated with successful invention.

Table 4. Main features of the agricultural extension system compared to those of its educational extensions.

Main Features in the Agricultural Extension Model	Cooperative Extension Service (U.S.D.A.)	Educational Extension Efforts (OE)	National Diffusion Network (OE)
1. A critical mass of new technology	Technology with a clear payoff, & understandable connections with previous practice	Technology developed from theory	Technology developed from practice
2. A research sub-system oriented to utilization	Yes, due to reward system for researchers	No	Yes, as R&D is conducted by D/D's
3. A high degree of user control over the research utilization system	Yes, through county planning councils	No	Yes, as R&D is conducted by D/D's
4. Structural linkages among the research utilization system's components	Yes	Yes, with help of ERIC	Yes, between D/D's & adopting schools
5. A high degree of client control by the linking subsystem	Yes, agent: client ratio of 1:500	Yes, in a pilot project	Reasonable client ratio
6. A "spannable" social distance across each interface between components in the system	Yes	Yes	Yes, as both D/D's and adopters are peers
7. Evolution as a complete system	Yes	No	No
8. A high degree of control by the system over its environment	Yes, e.g., through the AFBF	No	No

developed practices to assure that they meet professional standards, does not provide a feedforward capability to the research-performing elements of the RDDF system. Thus a third important feature which is lacking in the educational RDDF system emerges: the linkage between practice-based technology and research-based technology. The recent emergence of not-for-profit and commercial firms as developers and disseminators of innovative educational materials introduces an interesting new strategic element into this part of the system. Some of these firms are seeking to develop and commercially exploit educational technology, and thus represent a potentially important source of financial rewards for researchers or practitioner/inventors who create improved educational products, materials or practices. Whether the incentives to researchers or practitioner/inventors are adequate to stimulate an active market for educational innovation remains a question for further investigation. Clearly, however, if the linkage between teacher/users and inventor/technicians/researchers is to develop further, the existence of such incentives supported by an active market system would seem highly desirable. Recall, for example, that it was the commercial interests of the railroads acting in concert with the commercial interests of the Broome County, N.Y. farm bureau which provided the stimulus for the county agent role in the Cooperative Extension Service.

Thus we conclude that a partial answer to the future development of the educational RDDF system lies in the addition of a linking element capable of direct contact with teachers at the LEA level.

Responses to Current Status:

We can envision a three stage response to the current situation:

First Phase: Elaboration of the existing system to incorporate a local level linking element--the analog of the "county agent" in the Agricultural Extension Model. This might be implemented by an expansion of the number of NDN "facilitators" or R&D utilization facilitators. Special attention should be given to the following issues:

- o/ obtaining evidence that the presence of a facilitator/agent contributes to teacher and/or researcher productivity in excess of the costs incurred in developing and maintaining the function;
- o assessing the local and state support base for such an effort;
- o determining whether the reward structure inherent in the local environment of this facilitator/linker is sufficiently strong to attract qualified and respected candidates;
- o testing the ability of a facilitator linker to maintain a substantial "client ratio" and still work effectively with the research-based technical literature and to "feedforward" the needs and potentially researchable problems of the teacher/users.

Given the existence of the NDN program since 1974, phase one goals are perhaps attainable within a 3-5 year time frame.

Second Phase: Consolidation of the results of system elaboration. This phase can take several forms, depending on the reactions of local and state constituencies to the LEA linker/facilitator concept; the limitations placed on the role by the rest of the system; and the reactions of the role performers. The second phase should thus emphasize the concept of learning from past experience by: eliminating ineffective, unrewarding and unsupportable activities from the LEA facilitator/linker role and placing increased emphasis on the positive aspects of the phase one experience.

The objectives of this phase should include:

- o Obtaining the legislative and/or other forms of local support needed to provide a legitimate power base for the LEA facilitator/agent role.
- o determining the training and skill requirements for effective performance of the LEA facilitator/linker function;
- o experimenting with alternative ways of improving the feed-forward function, including the use of analogs to the research specialists in the Cooperative Extension Service, or perhaps with the "new breed" of information specialists acting at the ERIC interface;
- o building reward structures which will focus research on utilization goals;
- o exploring alternative "career paths" within the emerging system in order to facilitate mutual understanding of the norms and behavior patterns attached to the various roles, thus preparing to minimize "social distance" problems.
- o establishing the administrative structure needed to bridge the federal-state-local interface and determine the type and extent of intergovernmental support and cost sharing requirements.
- o assessing the concept of regionalism; its alternative dimensional basis; functions; number; and the position of regional centers in the administrative structure.

Phase two might require an additional five year interval beyond phase one.

Third Phase: Institutionalization of the role structure through professionalization of the emerging functions and recognition of career

tracks within the system. The basis for such a phase rests, of course, with the social and political forces which govern the exact outcomes of previous phases. If it is to resemble the Cooperative Extension Service, the institutionalized RDDF system for education will be explicitly recognized by law at the local, state, and federal levels as a unitary system with a power base at each level and a basis for cooperation and coordination of activities across jurisdictional boundaries.

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CHAPTER FOUR

KNOWLEDGE SYNTHESIS/TRANSFER: CONCEPTUAL AND PRACTICAL PROBLEMS WITHIN THE RDX SYSTEM

August, 1977

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Introduction

A. Objectives of the Paper

This paper is designed to provide the NIE-sponsored RDX (Research and Development Exchange) participants with (1) a review of the assumptions about policy formulation and implementation and about R and D systems that are made by producers and uers of "synthesis products" -- what are the implications for the development of the RDX system?; (2) a review of the "state of the art" in the area of knowledge synthesis/transformation--what methods are available? What are their strengths and weaknesses?; (3) a new operational perspective/process which can be used by participants in the RDX system for (a) formulating problems to be addressed by knowledge synthesis products, and (b) creating the synthesis product; (4) the implications of this perspective/process in terms of "staging the phasing"--i.e., implementing the RDX system over time on a step-by-step basis; (5) the implications for monitoring the development of knowledge synthesis products within the context of the RDX system; and (6) evaluate proposed RDX plans and make recommendations for changes, if needed.

B. Background of the Knowledge Synthesis/Transformation Component in the RDX System and the NIE

The Research and Development Exchange (RDX) was funded under the assumption that "R and D outcomes seldom reach the local school teacher, administrator, and decision maker in a form which they can use or act upon." In addition, as expressed in the Request for Proposal (RFP) on "Dissemination and a Feedforward System": "25% of the R and D outcomes produced by NIE are not available in a form they (users) can use." Thus one of the key components of a "successful" RDX system will be the ability to deliver "synthesized" information to "clients" (local school teachers, administrators, and decision makers) in a form in which they can understand and use it.

The development of the RDX system appears to correspond with a widely accepted obligation within NIE to pull together available knowledge in a form accessible to practitioners at the state and local levels. As already noted, it is critical that this information be useful to decision makers--useful both in substance and in form. NIE feels an acute need (within the context of the RDX system) to define what is meant by the "most useful information" for each of the primary audiences who should be benefitting from the creation of this information exchange.

Knowledge synthesis has traditionally been thought of as an effort to collate, compare, and/or interpret the current body of scientific and technical knowledge, including research results, outcomes of systematic development, theoretical and speculative writing and evaluations and verifications of current field practices. More recently, it has also been thought of as an area in which those interested in experimenting with (1) different media forms (print, microfiche, filmstrips, movies, etc.) and (2)computer based technology (computer conferencing, Abstracting and Indexing services, etc.) could make an important contribution. Essentially, within the context of users and clients, "synthesis" has been thought of as a problem in data reduction and coping with the "information overload problem." As such, it has been conceived of as a passive process that does not involve very much innovation and/or creativity. It is not a matter of creating new knowledge, but instead, summarizing research that is already completed. At best, the collation of knowledge, in this context, is a technologically challenging process; i.e., what are the most cost and resource efficient methods/tools that can be developed to perform this task? We would prefer to conceive of synthesis as an innovative, active process, which requires the generation of new knowledge; to be sure, this product is dependent upon the existence of research studies that can be incorporated into new knowledge through the process recommended in this paper.

It should be understood that the traditional way of thinking about knowledge synthesis (i.e., as a passive process) is consistent with an emphasis on end-products--what are the most useful formats? What types of synthesis are likely to be most attractive to practitioners, policy makers, and administrators? It is our conviction that this emphasis on end-products is likely to result in many information products which will not be used by the audiences for whom they are intended. Users are affected by the processes through which the end-products are produced. If they are not part of or do not understand the process, then the information is of little use.

C. Definitions

As part of beginning to understand these processes, it is necessary to reach a common understanding of what is meant by key concepts used in this area. Many of the distinctions have been blurred: (1) Is there a difference between knowledge synthesis and knowledge transformation? Knowledge synthesis has traditionally been thought of as a process by which all relevant knowledge is summarized for "particular problem at hand." The act of reducing large portions of knowledge into a manageable product (that can be understood by the client/audience/user) is the key concept in this case. In this traditional notion of synthesis, data reduction is essential. The idea of data reduction based on relevance or a quality judgment are not centrally part of this idea. Instead, all available knowledge in a particular area is "reduced into manageable form." Knowledge transformation, on the other hand, involves placing the available knowledge into some kind of framework or overall perspective; e.g., summarizing only that knowledge which is relevant to particular problems of interest to a particular administrator; and (2) Is there a difference between these two concepts and "interpretation and

analysis"? Interpretation goes beyond the formulation of a framework for the purpose of organizing knowledge to drawing implications and/or recommendations on the basis of the body of knowledge. At a minimum, it is argued in this paper, the RDX system should be engaged in knowledge transformation; some specific, client-generated problems may require interpretation and analysis.

D. Main Arguments of the Paper

In conceiving of synthesis as an active process requiring the participation of the technician responsible for producing the synthesis, the client receiving it, and if applicable and appropriate, the intermediary communicating between the two, we are (by definition) thinking of an innovation in the area of knowledge synthesis transformation and federal R and D policy. As Zaltman and Sikorski point out in another paper prepared for RDX participants, the term innovation refers to any idea, practice, or object which is perceived as new to a person or group who might potentially adopt it.

In terms of the arguments made in this paper, the "newness of knowledge" is key to our understanding. The literature teaches us that users are concerned with receiving up-to-date information--preferably, the most recent (new) knowledge (research) that is available at any given point in time. As already pointed out, traditional views and practices associated with knowledge synthesis do not require anything new. Instead, "old," presumably validated knowledge is brought together. It represents more or less an inventory or shopping list of what is available. The traditional view of knowledge synthesis is based on the assumption that individuals and groups should summarize all of the available information relevant to a problem at hand.

We strongly advocate an alternative view of synthesis/transformation which we believe does require innovation. If all participants are involved in

creating the synthesis product, then the process and knowledge are unique and new for all parties involved in the process. Furthermore, the process outlined in this paper reduces the paperwork associated with the synthesis process. There is no attempt made to collate all knowledge. Instead, the process provides criteria (a set of questions) for judging what information is relevant for the question at hand; then, all of the relevant information can be applied to a particular problem. This process increases the reduction of information and, at the same time, increases the potential impact and utility of the synthesis for the clients.

The process advocated in this paper seeks to establish consensus on the problems/goals to be addressed before the knowledge collation, analysis, and transformation process is initiated. In terms of the proposed RDX system, this refers to the goal-setting process at the national level, for the intermediaries, for the local agencies, and for the practitioners within the classroom. Essentially, the paper proposes to ask clients/users (at all levels of the proposed R and D system) to engage in the process of specifying the value of information to them in terms of agreed-upon goals and priorities. Thus, information value is expressed in terms of the extent to which the available information, in a given problem area, is related to a programmatic goal or objective at all four levels (i.e., federal, state, local, classroom) within the sytem, at three levels, at two levels, and at one level. The information value concept must also possess the capability of dealing with conflicting goals and objectives. However, if goals, priorities, and objectives are not clearly stated, then it is difficult, if not impossible, to make judgments about the value and relevance of the available information.

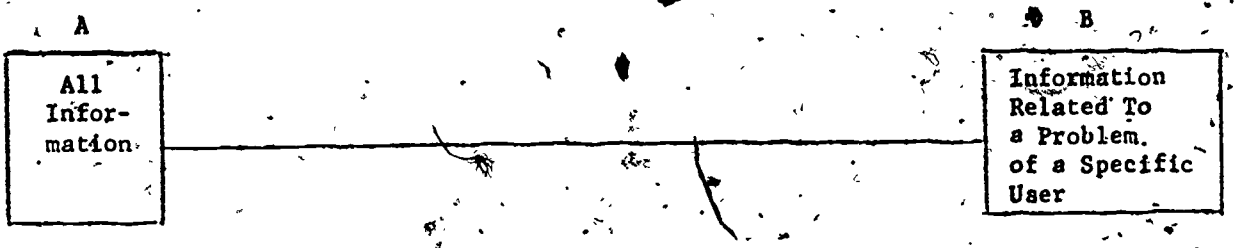
The exercise of specifying information value seems particularly appropriate for the RDX system. This task will be facilitated through the use of trained

intermediaries. The literature in this area teaches us that intermediaries can be most effective when there is a clear understanding of the goals and problems that are being worked upon. As the President's Commission on Federal Statistics points out: "The basic difficulty lies in defining the goals of a program...Users are simply not good at defining what it is they need." Unless we engage in this type of training that will increase users' ability to define goals and formulate clear options, knowledge transfer/synthesis will continue to be plagued with the same problems it has faced in the past. In order for a research and development system to be successful, potential users must be capable of defining what information they need; at least, it should be possible for them to participate in a process which will result in defining these needs.

In Figure One we have attempted to contrast the perspective put forward in this paper with the traditional view of knowledge synthesis. One can conceive of the differences between the two views as the two end points on a continuum. Participants in the RDX system concerned with knowledge synthesis will have to locate themselves on this continuum. Presumably, the process put forward in this paper (if adopted) would urge people to emphasize the right-hand side of the continuum.

Figure One

"Criteria for Choosing What Information to Include in a Synthesis Product"



Clearly, this goal of specifying information value represents an "ideal solution." Sub-optimally, this paper offers two other concrete products: (a) a review of current practices (based on the empirical literature in the areas of knowledge synthesis and utilization); and (b) a set of suggestions for reforming some of the existing practices. Hopefully, the RDX system (in its early stages) may try to adopt the information value process.

I. Expectations and Functions of a Knowledge Synthesis Component

In terms of specifying the appropriate knowledge/transformation synthesis functions within the RDX system, it also seems important to outline the expectations of various users of traditional synthesis products as well as the functions that a synthesis component of an R and D system could and should play.

First, one conception of the capabilities/capacity of a synthesis component of the RDX system would be: An end-product of the synthesis process should have met the following criteria:

(1) Consensus should be reached between the producers and users of the synthesis as to the problems that the synthesis product should be addressing;

(2) Given that problem, an appropriate range of data (i.e., measured in terms of relevance to the problem at hand) should be examined for possible inclusion in the synthesis;

(3) The data included in the synthesis should be of high quality (measured in terms of traditional scientific criteria);

(4) Data should be organized in a way that addresses the questions of greatest concern to users;

(5) Support should be provided for the users (e.g., translation of data into understandable language).

As already noted, this conception of synthesis is not shared by those in and out of government who traditionally have been engaged in the business of producing synthesis. It is, however, our belief that a comprehensive set of synthesis related functions, of the kind outlined above, can and should be included in the RDX system.

In proposing this set of functions, it seems important to distinguish between three types of R and D related activities: (1) the synthesis process (traditionally conceived) itself--i.e. summarizing knowledge into some kind of communicable end-product; (2) the brokerage function--i.e. an intermediary who provides "support services" by communicating with knowledge producers and users in order to increase the "goodness-of-fit" between the needs of users and the knowledge available related to a particular problem; and (3) the training and/or socialization of clients (consumers) in specifying what problem they are trying to solve and what information they need (i.e. reaching consensus). It is clear that knowledge synthesis has not traditionally been thought of in terms of support and training functions.

In putting forward these functions, it is equally clear that we need to distinguish between various types of users: (a) researchers; (b) teachers; (c) policy makers; and (d) administrators. The traditional conception of synthesis is strongly related to the needs of researchers: to be on top of all available knowledge in a given area. The other potential users of the RDX system are deeply immeshed in the political process; hence, the constraints and pressures placed upon them often make the passive conception of synthesis irrelevant and of little use; at a minimum, this conception makes the process inaccessible.

II. Major Constraints on Adopting an Innovative Conception of Knowledge Synthesis/Transformation

These conceptions of what the knowledge synthesis process could and should be represent little more than theory unless powerful constraints are overcome: those related to the assumptions generally associated with the traditional knowledge synthesis process:

(1)the primary problem that knowledge synthesis processes are designed to solve is related to information overload; thus, processes which lead to data reduction are critical; (2) the knowledge synthesis process, as traditionally defined, is a natural part of scientific communication; (3) the "better mousetrap theory" works; i.e., if information is provided in a form that is understandable to users, the "synthesis" will automatically be used; (4)the major problems associated with knowledge utilization at the present have to do with knowledge specific problems; i.e., those associated with form timeliness, available technology and amounts of knowledge available. If these barriers can be overcome, then utilization will automatically follow; and (5) knowledge synthesis is needed and will be welcomed by potential users in the educational community.

It is just the set of assumptions outlined above which has led NIE (and it is recognized in the planning for this program) to confuse the more basic issue of adequacy (in terms of quality), relevance, and comprehensibility of the synthesis work with the incentives and needs for formulating a comprehensive strategy for knowledge synthesis processes. Given the fundamental consensus (value) outlined above, we can begin to use the knowledge synthesis process to inform our efforts in the area of training, research development, and planning. This can be done with a variety of media forms--traditional books, articles, interactive computer systems, computer conferencing, conference calls, and many other methods of this kind.

III. Discussion of the Assumptions Behind the Knowledge Synthesis Literature and Field Practices

A. The Information Overload Problem

It is commonly reported throughout the literature that more knowledge crosses a potential user's desk than he/she can possibly assimilate and constructively apply to a problem at hand. There are not particular guidelines available which tell him what is of high quality and what isn't, and generally what would be most important to read and what wouldn't. How can he effectively allocate a limited amount of time so as to be exposed to the most available information?

Those engaged in knowledge synthesis view their activities as centrally related to responding to this problem. Through a variety of means (intellectual and technical), it is possible to reduce the available knowledge to a manageable form that will make efficient use of the limited time available to individual clients. Instead of having to leaf through piles of papers, one article or series of abstracts can be read. The problem of assimilating and constructively applying information to a problem is particularly intense in the "soft sciences" (education and social sciences included). In the physical sciences, experiments are conducted starting from the basis of what is known in a given area; this same scientific method is not rigorously applied in the "soft sciences." Thus, there is so much redundancy in the literature, that even random selection of materials may produce more information than is needed (or can be used) for a given problem.

Knowledge synthesis, according to its advocates, can filter, condense, and validate available information in an area of interest to a potential client/user. This initial screening process is viewed as an invaluable aid to decision makers and other users. On the basis of screening and validation, rational decisions (in terms of efficient use of available time and resources) can be reached concerning

what other information should be collected (if any) and what "option for decision" makes the most sense.

Although this is a commonly held assumption, it seems to us that it represents a rather undifferentiated view of the "information problem." Indeed, as Caplan discovered in his interviews with 204 federal executives (political appointees), users/clients complain about not having access to the best available and highest quality information. Thus, we are not dealing with a simple information overload problem. There may be an overload of irrelevant information and a scarcity of relevant information--for the particular problems "at hand."

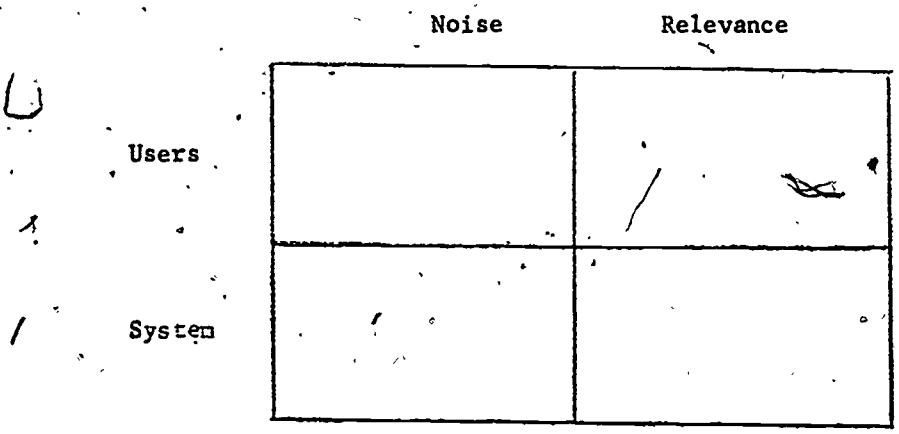
By not differentiating carefully between potentially relevant and irrelevant information, the knowledge synthesis field has developed the practice of collating and summarizing all available knowledge in a particular area. Thus, although the synthesis process represents some actual data reduction, it still provides the client with a paucity of relevant information that will allow for the most rational decisions in terms of developing an information-search strategy.

It is useful to think of the so-called information overload problem in terms of individual users and the RDX system, as a whole. In Figure Two, we attempt to illustrate how one might think about this problem. It is easy to think of what constitutes noise for an individual user, but what about for the RDX system as a whole? Similarly, how does one judge relevance for a system as a whole? The systematic level will have to be addressed over time, as the system begins to develop an organizational memory (see section on staging and phasing, and the Bean/ Rogers paper).

The problem of differentiating noise from relevant information is further complicated by the fact that education (and educational policy) is a derivative discipline. Thus, in some fundamental ways, the field of education represents

Figure Two

"The Information Overload Problem"



the product of a synthesis--taking and drawing together materials from other areas. Since there is not very much original research in education that is "paradigm building" (as Kuhn would define it), an inherent process of sub-optimization has been going on in education for many years.

In terms of the so-called information overload problem, it is also instructive to cite some of the relevant literature related to this assumption.

Burchinal, for example, says that local educational information centers (the focus of his study) should know ALL large scale sources of knowledge. Within the context of educational policy, Abelson suggests that teachers need to be exposed to the most current ideas so that they will be able to transform ideas/knowledge into practice. The ability to translate ideas into practice, according to Abelson, rests on the comprehensibility of the knowledge. Similarly, Glaser underlines the importance of increasing the impact of research findings by reporting them in a readable, brief, and non-technical form which are widely distributed to potential users/clients. These types of readable ideas, according to Glaser, provide the basis for forming a "mind-set" about an issue. This mind-set may stimulate further interest in this area.

Indeed, these short excerpts from the literature underline the traditional synthesis conceptions already referred to: (a) synthesis provides current knowledge; (b) synthesis puts together all sources of available knowledge (the purpose of information centers according to Burchinal); and (c) synthesis stimulates further interest in an area--thereby, increasing the impact of knowledge and providing a rational basis for further investigation into a particular problem area.

B. Technology Driven Solutions

The conception of synthesis as a primarily data reduction oriented activity has encouraged the development of information technologies designed to serve those responsible for knowledge synthesis related activities. As previously noted, if one conceives of the major problem facing an R and D system as one of data reduction, then one is almost obligated to think of synthesis as a passive process. As such, one automatically thinks of the most cost efficient way in which to reduce the vast bulk of available information into a useable form. Naturally, technicians (especially computer technicians) are attracted to this perspective. Computers can be used more efficiently than simple human manpower in reducing information. Programmed correctly and appropriately, computers can reduce data quicker and more efficiently (in terms of cost) than any group of individuals by themselves.

Computer technologies capable of performing these synthesis related activities have been developed in response to the information problems/pathologies defined by the federal government and by many in the private sector as well.

It is our belief that computer technology has been substituted for a conceptually derived framework for knowledge reduction activities. As suggested earlier in this essay, some framework is needed for the purpose of judging value and relevance. A computer or other mechanically driven technology cannot

provide this service for us. Thus, in encouraging this type of activity we have tended to by-pass what seems to us to be the most essential need in the knowledge synthesis/transformation area.

In our analysis, we do not mean to discourage the development of hardware and technological innovations. It is simply our belief that the needs of the RDX system can best be met through the simultaneous development of institutional and technological innovations. Hardware will be necessary, appropriate, and useful if the institutions responsible for formulating and implementing the RDX system also engage in innovation; one cannot rely on hardware to do this for us.

C. A Belief that Knowledge Synthesis Processes are Naturally a Part of Scientific Communication

In his study of diffusion, Dahling found an idea spreads fastest within a discipline in which related work is going on when the authority of the source is recognized, and the vocabulary and methods are similar. He goes on to point out that ideas gain currency and some "flurry" when related activities give rise to it. Finally, Dahling's study concludes that ideas spread from one discipline to another when they clearly deal with matters of common interest. This study also points out that the spread of scientific ideas via the populous mass media is limited. Thus, for the diffusion of scientific ideas, one must rely on accepted methods of scientifc communication.

In another study of innovation, Rogers and Shoemaker point out that as individual members of a social system share a common base of knowledge about a particular innovation, the chances of adoption increase. Like Glaser, these authors are making a linkage between means of communication and ultimate impact.

Both the Dahling and Rogers and Shoemaker study are illustrative for a class of studies which focus on methods of scientific communication and their impact.

From the perspective of the traditional knowledge synthesis process, it is clear that the proponents of this process see themselves as being directly responsive to the problems outlined in these studies:

1. Knowledge synthesis processes were designed to communicate to various audiences the types of other knowledge related to the problem they are interested in with a vocabluilary that is comprehensible. It is also designed to collate scientific findings and not rely on popularizing of them before disseminating the results. Indeed, traditional knowledge transformation processes may provide the kind of framework that would illustrate the interconnections of various fields of research.
2. In addition to data reduction-related activities, knowledge synthesis processes are designed to provide audiences with a summary of the available knowledge in a particular area. This provides a common base of understanding; from this common base individuals can decide whether to develop their expertise by delving further into an area or whether the collated summary is sufficient for their needs.

Clearly the field of scientific communication is centrally with creating viable mechanisms which will allow scientists to share knowledge with each other. Chesler points out that the ultimate impact of scientific knowledge is dependent upon researcher to researcher feedback and exchange. It is equally clear that knowledge synthesizers see themselves as being directly responsive to the agenda of those concerned with the field of scientific communication.

Within this context, the central question becomes: are knowledge synthesis processes directly related to facilitating more effective (in terms of costs and the allocation of time resources) means of scientific communication? To what extent are scientists/researchers likely to rely upon knowledge syntheses as a

means for gaining a "common background" in a particular area? To what extent will they rely upon it for the diffusion of ideas?

It is clear that when most researchers have a problem, they, like decision-makers, do not search through all the available knowledge in a particular area. It is simply not efficient for them to engage in this type of search. Instead, they are likely to telephone a colleague concerning the "problem at hand"; the colleague is likely to be able to provide some citations, or the name of other colleagues to communicate with. This loose, informal network is usually sufficient to meet the scientist's immediate needs; i.e., bringing him up-to-date with the most current, validated knowledge relevant to the problem he is interested in. This informal network is only able to operate successfully (i.e., meeting the needs of those who are part of it) because (1) scientists/researchers are constantly engaged in the synthesis/transformation process; i.e., collating information and integrating it within the framework of the knowledge and perspectives they are already familiar with, and (2) they know who to contact for the problems they are working on. Scientists are able to "walk down the hall" or pick up the telephone because they are in touch with the experts who are most knowledgeable in the areas they are interested in. Thus, there is really no incentive for them to make use of formal knowledge synthesis products--especially when they do not differentiate for relevance. This is the crucial test which colleagues are definitely able to meet.

In addition, as Rosenbloom and Wolek point out, scientists are not likely to make substantial use of sources outside of their corporation (i.e., their immediate association, department--relevant unit). "In aggregate, only about half of the information acquired resulted from a specific search by the respondent. . . the information was acquired because someone pointed it out without being requested to do so." The study went on to show that scientists and

practitioners have established means for collecting and processing information. They are not likely to adopt a new source of information.

Within this context, one should be careful to point out that there are differences between various types of researchers (i.e., university, members of for-profit institutions, industrial) and researchers who are beginning to explore a new field of research. Industrial scientists are more likely to rely upon a formal synthesis system. Other researchers would be more inclined to test such a system when they were beginning to explore a new field. However, it is nevertheless the case that informal networks are relied upon more often than formal synthesis systems.

D. Implications of Scientific Communication for Synthesis

It seems to us that the knowledge synthesis field has simply assumed that there would be a market for their products, irrespective of developing incentive structures. Indeed, some of the existing incentive structures have helped to support this assumption. Some laws, for example, require officials to consult data; this is true of the New Jersey "Thorough and Efficient Legislation." Officials are held accountable in terms of examining data information. This type of accountability may artificially inflate the market for synthesis related products.

In terms of scientific communications as a possible incentive for helping to develop incentive structures, it is certainly true that the general goals at the foundation of knowledge synthesis processes are part of scientific communication; however, the particular manifestations in terms of particular products may not have any appreciable impact upon clients--at least, in terms of researchers and decision makers.

At the same time, however, the scientific communication also provides a basis for the recognition of knowledge synthesis processes as being central to scientific communication in general. Becker's work is representative of a group of studies which analyzes the role of opinion leaders. The notion of opinion leader applies to information channels outside the client's organization. Professionals are motivated by a desire to maintain or increase professional status; they also want to be part of the "mainstream" communication network of their professional group. They will be influenced by peers who are recognized for their authority; this is just the reason for contacting colleagues who can pass on "authoritative" information or provide access to authoritative leaders. Thus, these leaders (what Becker calls opinion leaders) can potentially be employed as part of the knowledge synthesis process. They can be instrumental in increasing the legitimacy of this process. (See section on Glaser's work for an example of this.) Indeed, it is our conviction that one should not make assumptions about how the market is likely to behave. It is important to assess the market and formulate a strategy for selling one's product. This is part of the active synthesis process proposed in this paper, and developed by Kotler et al. in their paper on marketing in the RDX.

E. A Belief in the "Better Mousetrap" Theory

The lack of attention that has been given to incentive structures by those concerned with knowledge synthesis reflects a rather deeply embedded belief that clients/audiences will recognize the value of a synthesis product once they are exposed to it. As NIE has recognized, there appears to be a basic assumption in the literature: nonutilization of syntheses by educational practitioners and policy makers is due to the fact that they do not have access and/or are not aware of syntheses of the best knowledge available from research and practice. "Best" knowledge, in the context of this literature, refers to high quality materials--

it is not a judgment of information as specified earlier in the paper. It is strongly believed that teachers (practitioners) and policy-makers are in search of generally accepted information on how to structure the classroom, what instructional materials to use, how to use them, where to obtain the materials, or where to obtain help on structuring the classroom. It is the design and goal of knowledge synthesis processes to meet these needs. Thus, once it is available, "people will beat a path to the door of synthesizers" in order to obtain these materials.

However, it is true that even when syntheses are available, use and application do not automatically follow. In part this is due to the fact that researchers cannot agree on what constitutes the best available knowledge. When there are basic disagreements on this point, the knowledge synthesis process is caught in a state of confusion. What should be included and excluded and on what basis do we make these judgments? Any answer to these questions is likely to be somewhat arbitrary in the absence of clear scientific criteria. Thus, it is no surprise that practitioners, intermediaries, and decision-makers feel more comfortable relying upon their own intuition and training.

In addition, the knowledge synthesis process provides little basis for deciding what constitutes the best knowledge. Most syntheses present a rather undifferentiated collation of the available materials.

Traditionally, in the area of the social sciences "best" has been determined by the norms within the field at any given point in time, instead of any criterion reference tests. We need to move toward criterion reference tests in the synthesis area.

These tests and standards are necessary if syntheses are expected to have any measureable impact on clients/users. If impact

and utilization are to be central goals of the knowledge synthesis process, then it must formulate a process which will provide the basis for providing a differentiated view of the available materials. This is our reason for recommending a process which will lead to the specification of information value. Indeed, the normal patterns of scientific communication provide a powerful constraint on adopting new approaches for information searches. In the absence of an innovation like the process which leads to the specification of value, we may stand little chance of increasing levels of impact for the audiences that the RDX system is designed to reach.

F. Knowledge Specific Constraints

The traditional assumption of the better mousetrap theory is closely correlated with a belief that utilization and application is a function of close linkages between the research community on the one hand, and the practitioner and policy-making community on the other. Generally speaking, it is believed by the research and policy-making communities alike that factors such as timeliness of data, objectivity, communication barriers, cost of research, and political feasibility play major roles in limiting the level of utilization.

While some authors may stress one of these factors over another in explaining barriers to utilization and the adoption of innovations, it is presumed throughout the literature that if these barriers can be overcome (i.e., if data were more timely, higher in quality, more relevant, in the proper form, more communicable, etc.) then utilization and application would automatically follow regardless of the source. In other words, what needs to be done to facilitate utilization is to increase a "goodness of fit" between the knowledge deemed requisite by policy makers and the knowledge produced by researchers.

While there is no explicit theory of utilization in the miscellaney of "factors affecting" articles, there is one major underlying assumption which implicitly serves as the foundation for these ideas; namely, that utilization can only take place if these barriers are overcome. It is presumed that policy makers strive for increased rationality within the context of an open inquiry system. The open inquiry system, in turn, is suspected to result in increased rationality in decision-making.

More specifically, the literature as a whole makes several critical assumptions concerning the relationship between knowledge utilization and decision-making:

First, there is an assumption in much of the literature that (a) decision-makers are rational and (b) that they follow rational decision-making processes. Rationality refers to the scientific conception of it; i.e., it follows the scientific method. When a person has a problem, he searches widely for information in order to reduce uncertainty over the potential solution. The information search extends to all places and sources where relevant information might be available and the reduction of uncertainty refers specifically to the confidence that the person can have in the solution he has come up with. Thus, in the policy arena, rationality refers to the desire of decision makers and administrators to collect, be exposed to, and willing to use quality informational inputs, regardless of source, relevant to their decision-making agenda within the practical limits of economic, political and social constraints. This form of scientific rationality can be contrasted with bureaucratic rationality. Bureaucratic rationality is also concerned with reducing uncertainty, but is set in the political as opposed to the scientific arena. Bureaucrats seek to reduce risk in the sense of embarrassment to themselves or to their agency in terms of prestige, budget resources,

etc. Thus, information searches are usually limited to trusted aides within their departments.

Second, related to rationality, it is assumed that decision-making processes can best be characterized by a linear input/output model: Given a set of decision making processes, certain specified inputs will produce (automatically) specified outputs. In this particular case, the inputs are information-related characteristics represented by timeliness, policy relevance, communication linkages between policy-makers and researchers, form (style), objectivity, bureaucratic/organizational rules and procedures, and political feasibility: The outputs are assumed to be utilization and specific practices of decisions within the education field.

Third, this narrow view of rationality (i.e., not distinguishing between scientific and bureaucratic rationality AND basing practice on a belief in scientific rationality) is consistent with a short-term perspective on decision making. In this short-term perspective, planning (e.g., formulating an overall process to guide the synthesis process) is not advocated; instead, decision making and the administrative practices/procedures associated with it are viewed as the product of small, incremental steps. A lack of planning helps to support a continued reliance upon bureaucratic rationality.

G. Open Systems of Decision Making

In examining the hypotheses advanced in the literature one overriding assumption emerged that cuts across each of the discrete assumptions and factors concerning the relationship between utilization and decision-making: Policy makers and practitioners are receptive to all kinds of informational inputs (soft/hard, in-house and extramurally produced, instrumen

Thus, their knowledge inquiry system may be best described as open. An "open knowledge inquiry system" can be characterized in the following manner: When the policy maker is confronted with a decision in which he has inadequate information about the relative merits of several alternatives, he seeks from various sources knowledge bearing on his problem, becomes familiar with it, and all other things being equal (e.g. quality of information, communicability, timeliness, political feasibility) selects the optimal alternative supported by the greatest amount of tested information; thus, he is acting rationally.

In this model, the knowledge inquiry system involves a set of information retrieval and transmitting activities which recognizes the importance of searching and drawing freely from well-sampled knowledge and exhibits a willingness to use that "best" knowledge, regardless of its source. These characteristics are analogous to those commonly attributed to an "open decision-making system" and/or the rational decision-maker.

There is not one complete article or book in the literature which describes the open knowledge inquiry system of decision making and utilization or which presented evidence of findings which substantially conforms to the operation of such a system. Taken together, however, the open inquiry system is clearly implied throughout the literature.

Specifically, in the area of knowledge synthesis it is clear that these general assumptions concerning the salience of knowledge specific characteristics also emerge. Joly, for example, suggests that a significant estrangement exists between researchers and practitioners over definition of terms, observations of different samples, and other problems of this kind(e.g. format). Mackie expresses a concern over reaching a common understanding about the meaning of research findings. He believes that users are generally incapable of formulating their problems in research language and vice versa. Similarly, Schwartz

concludes that effective utilization will only increase when more effort is made to generalize findings to broader publics--especially to professionals, and volunteers who are responsible for action programs. He identifies two cardinal sins: the sin of ommission--information doesn't go to audiences who could use it, and the sin of commission--errors of act or misinterpretations. All of these studies point to the need for "linkage"--bringing the two communities together and facilitating a match or better fit between patterns of knowledge production and the information requirements of practitioners and policy-makers. Lingwood and Havelock, in another paper written for RDX participants, also point to some of these same assumptions which serve as barriers to utilization.

This emphasis on knowledge specific characteristics does not distinguish between relevant and irrelevant information. By trying to facilitate utilization and application irrespective of relevance, one risks the possibility of loading down users with information that will be of little use to them in their problem-solving activities.

It is just this concern for linkages that has served as the backbone of the knowledge synthesis process. A discussion of open knowledge inquiry systems serves to underline the fact that barriers related to knowledge specific characteristics may be overcome without resulting in increased levels of utilization. In a study of the Continuous National Survey, which was available to practitioners and policy-makers in the educational community, Rich found that the formidable barriers underscored in the literature were overcome. Perhaps the CNS experiment came the closest to meeting these requirements of any formal information system in the educational area. This experiment funded by the National Science Foundation/Research Applied to National Needs Division also built upon the findings

of the diffusion of innovation literature outlined by Zaltman and Sikorski in their paper for RDX participants. Nonetheless, despite the fact that the information requested from the CNS was tailored to agency needs and provided quickly, by a highly reputable research group without cost to the agency, Rich found considerable discrepancy between the level of anticipated and actual use of the data. The levels of use of the service were less than expected and the information provided to those who requested it for intended use did not use it to the anticipated degree.

Only five of the seven participating agencies made use of the CNS. Given the fact that policy-makers requested the CNS data with concrete uses in mind, it seems natural to expect very high levels of utilization. The findings, however, fail to sustain these expectations. In only sixteen of forty-four cases of information requests studied did Rich find that the expectations for utilization were actually met for the information collected during the 18-month period in which the CNS was in the field.

In terms of knowledge synthesis processes, these data point to the need to rethink our assumptions which are at the foundation of current knowledge synthesis practices. The CNS provided synthesized information to clients according to the specifications outlined in the literature; all indicators of success were built into the system. The knowledge inquiry system did not work. Thus, we need to give more attention to source and organizational/bureaucratic constraints and interests (see Gross and Mojkowski papers on interorganizational management and the RDX system). This same theme prevaded our earlier discussion of the central assumptions associated with patterns of scientific communication.

Summary and Implications for Knowledge Synthesis

This discussion and analysis of traditional assumptions points to the need to rethink some of our approaches to knowledge synthesis. First, we should not assume an immediate receptivity to knowledge synthesis processes by decision makers, intermediaries, and practitioners. Channels of communication and feedback need to be cultivated and maintained. Second, knowledge synthesis is conceived of exclusively in terms of data reduction. Meaningful data reduction (that increases rationality and efficiency) will be based on some standard of relevance and value. Up to now, when the literature speaks of relevance it seems to assume most, if not all, knowledge is available in a given problem area. Third, knowledge synthesis is not necessarily automatically part of scientific communication. It should be remembered that other channels of communication are preferred by many audiences. Again, we should not presume to be part of these channels, even though there may be great potential for development. Fourth, a realistic assessment must be made of the strengths and weaknesses of current knowledge synthesis practices and the barriers to their adoption. At the moment, we may be attacking the wrong set of problems.

IV. Current Synthesis Practices: An Illustration of Assumptions

In terms of synthesis practices in the educational community, we can learn quite a bit from NIE's own survey of knowledge synthesis related activities.

1. The vast majority of syntheses are either "state of the art" papers or "critical reviews" (i.e., interpretation of the literature with an evaluation of the quality of the content).
2. The vast majority of syntheses have as their purpose providing the user with an overview of current knowledge.

3. The intended users of these syntheses include a broad spectrum of audiences ranging from policy-makers to local school teachers and administrators.
4. The process used to synthesize information was primarily aggregation of information related to a specific area.
5. The content of these syntheses was primarily derived from one discipline.

Moreover, this survey showed that in terms of knowledge related to practice, consolidation (collation/synthesis) occurs within the context of available frameworks. Very few new frameworks were established. Given the assumptions at the foundation of the synthesis field, these results should come as no surprise.

A. Producing "State-of-the-Art" Papers

As the data from the NIE survey indicate, "state of the art" papers are the primary mode of synthesis relied upon in the educational area. These papers are designed to highlight the most important findings in a particular substantive area.

Edward Glaser has recently completed some groundbreaking work in the knowledge synthesis area which recognizes some of the shortcomings of the traditional assumptions in this area. In 1967, Glaser began to develop an innovative process for producing "state-of-the-art papers." His first pilot effort was completed in the area of knowledge related to care programs for patients with chronic obstructive pulmonary diseases. As part of this work he conducted a survey concerning current practices with respect to diagnosis, treatment and rehabilitation of these patients. This survey was followed by a three-day workshop for 49 persons

actively involved in the treatment of these diseases; physicians, respiratory nurses, and physical therapists were represented. Participants also included equally experienced and knowledgeable critics of the programs developed in this area of medicine. A report was produced as a result of this meeting; the report presented a consensus on a minimal program for diagnosis and comprehensive treatment of patients with chronic pulmonary obstructive disease (COPD).

As a follow-up to this conference, Glaser received funding for the development of a broadly based state-of-the-art consensus. A team of nine top researcher-practitioners in the COPD field were recruited (six had participated in the previous conference).

These nine physicians were brought together for a two-day meeting. They exchanged ideas on what was the best current knowledge and practice with regard to diagnosis and comprehensive care of persons suffering from COPD. On the basis of this meeting, one member of the group agreed to prepare a preliminary draft of a paper. The draft was then critiqued by other members of the team; on the basis of this critique other drafts were completed. After the fifth draft was completed, other prominent persons in the field, outside the team, received copies of the paper; twenty such persons received the paper. Drafts were then revised until 160 colleagues in the COPD field had received drafts of the paper. Only after the 14th revision, and several different authors of the paper, was the article published in the Journal of the American Medical Association.

Within six months of publication, over 7500 requests for reprints had been received as well as more than 100 letters in response to an invitation for critique.

On the basis of this experience, Glaser concludes that there are four key procedural steps which should be followed for developing a knowledge base that present current state-of-the-art papers in a given field:

A. Strive for clarification and shared support of the research idea.

B. In the research process, work out agreed-upon procedures with those involved in creating the state-of-the-art paper; interaction with key persons in the field should continue until the point of diminishing returns--no matter how many revisions this may require.

C. Develop contacts with relevant professional societies and with government for enlargement and coordination of communication networks.

D. Provide for follow-up and feedback.

Basically, Glaser attributes his success to the process followed in completing the synthesis product. It is our contention that he followed some of the same principles advocated in this paper: (1) He did not assume that he would automatically have an audience for his synthesis once it was completed in a form that was understandable to his audience. He cultivated a wide-ranging audience based on the lessons learned from the scientific communication literature. Experts tell other experts about "current awareness" topics. Members of Glaser's panel undoubtedly told their colleagues about this work. Thus, through normal diffusion patterns he was successful in building up a wide-ranging clientele. (2) This experiment in knowledge synthesis believes in building a consensus. Through the use of panels, consultants, and reviewers, Glaser reached a consensus on problem definition and the best and most important materials to be included; and (3) Glaser's experiment illustrates the need to develop a more open inquiry system. If a client is going to reach beyond his own organization for information, this information should come from opinion leaders. Through the process of creating this synthesis, Glaser created a panel of opinion leaders. It is also clear that Glaser was using his panel to make judgments about relevance to a particular problem.

However, it is also equally clear that Glaser's methods also present some problems for the development of the RDX system: (1) It is not at all certain that the successes evident in the biomedical field can be transferred to the educational field. In medicine the participants (and ultimately the 160-person network that was consulted) started with a common vocabulary; in the social sciences this will not be possible. Considerable time would have to be devoted to socializing the panel to a common set of terms; (2) The process experimented with by Glaser is costly in terms of the human resources that are devoted to the effort; one would expect the resources and time devoted to this process to increase when applied to the field of education; (3) Thus, the time taken to complete a synthesis (state-of-the-art paper) would probably be longer than practitioners or administrators could wait for, if they had a problem of short-term concern. Should the RDX be put in the position of saying; "You will have to wait until this process is completed"? (4) To what extent can the process related to "best practices" be transferred to a synthesis of the literature? Again, due to common vocabulary and a commitment to solving a problem, it may have been easier to reach consensus in this area; and (5) In the educational area, questions of values become very important; how can this be accounted for in the Glaser system?

Overall, we feel that Glaser has made an important contribution to the development of this field. However, the price of reaching consensus through his recommended process may be too high given the time and resource constraints on the participants in the RDX system. Furthermore, the end-product is dependent upon the judgments of experts. They are exposed to many inputs from potential users; they must decide on what to include and what to exclude from their final product. In an area (like medical technology) where expert judgment is respected

and sought after, this process might work. However, in an area like education where no one is so respected so as to demand the attention of the entire community, this process may be counterproductive and wasteful.

B. Producing Meta-Analysis

In the area of education, Gene Glass has introduced the newest innovation in the knowledge synthesis area. Glass contends that in the area of educational research, synthesis products can most appropriately be produced through the use of meta-analysis. Meta-analysis refers to the analysis of analysis. It refers to "the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings."

He feels that the need for this kind of work is clear: (a) the literature in many areas of education is growing at an astounding rate; (b) the findings are fragile and vary in confusing irregularity across contexts, classes of subjects, and methodologies; and (c) there is a hidden consensus between many studies. The reason why the consensus has not emerged is due to the fact that disagreements have occurred over essentially scholarly matters: choice of methodology, statistical tests, etc. Glass contends:

> In educational research, we need more scholarly effort concentrated on the problem of finding the knowledge that lies untapped in completed research studies. We are too heavily invested in pedestrian reviewing where verbal synopses of studies are strung out in dizzying lists. The best minds are needed to integrate the staggering numbers of individual studies. The endeavor deserves higher priority than adding a new experiment or survey to the pile.

Glass has attempted meta-analysis on several questions. In one case he set out to integrate the outcome evaluation literature in psychotherapy and counseling. Through an extensive literature search, nearly 400 controlled evaluations of the effects of psychotherapy were found. Each study was described in quantitative or

quasi-quantitative terms in several ways. Most important was the "effect size" of the therapy: the mean difference "between treated and untreated subjects divided by the within group standard deviation." Thus, a study could be described as showing .5 or .75 or .25 standard deviation effect of the therapy. In all of these studies, there were more effect measures (800) than there were studies. Glass quantified the properties and findings of these studies.

In general, he found that (a) on average the therapy group mean was about two thirds standard deviation above the control group mean on the outcome variable; (b) the four types of therapy are not greatly different in their average impact; and (c) (a rather startling finding) the effects of behavioral and non-behavioral therapies are only trivially different. "...The available evidence shows essentially no difference in the average impact of each class of therapy."

Glass's research group has also attempted the same form of meta-analysis in the area of studying the relationship between socioeconomic status and school achievement. White (1976) collected over 600 correlation coefficients from published and unpublished literature. He subjected the coefficients to extensive analysis to determine how their magnitude was related to varying definitions of SES, different types of achievement, etc. The analysis reveals that the SES and achievement correlation is below what is generally believed to be the strength of association of the two variables.

Clearly, Glass has made an important contribution to the knowledge transformation/synthesis area: (a) he is able to address decision makers' concern that "social scientists can never agree on any subject." He is able to report the degree of agreement, and the statistical significance of any disagreement that has occurred; (b) thus, his meta-analysis methodology also provides a way of validating "established findings" in a given area or of assessing the extent to which new findings are consistent with the "state-of-the-art"; and (c) he

has provided a way to help organize the complex data in the educational area. In addition, unlike Glaser's approach this method does not demand a heavy investment of human capital. It does, however, take some time to locate and analyze the literature.

The Glass approach is, however, consistent with many of the facets of the traditional synthesis approach. Most notably, it is a passive process which attempts to summarize all available knowledge without any organizing framework. The only framework used is the criteria of reporting levels/degrees of agreement and disagreement in the literature.

In terms of the process recommended in this paper, we would employ Glass's approach once agreement was reached between producers and users as to the problem that the synthesis was supposed to address. Users should also be consulted concerning the particular area that the meta-analysis was supposed to address. Glass himself makes a distinction between prospective and retrospective syntheses. Prospective synthesis is the attempt to address the literature with specific categories in mind. Glass would prefer a retrospective approach which collates all available knowledge and reports on the degree of consensus. Users can then (retrospectively) fit these results into whatever categories they feel are appropriate. Again, an automatic market (that does not need to be cultivated) is assumed.

Within the context of the RDX system, Glass's approach would have to be refined and limited in application to problems that were subject to general analysis. Also, his approach should only be used well along into the synthesis process (see section on specifying information value).

In contrasting the Glass and Glaser approaches it is possible to say that Glaser emphasizes the allocation of resources to intermediaries responsible for producing the synthesis; Glass prefers to devote resource to computer analysis which

can process large quantities of information efficiently. It is also fair to say that Glass feels that integration in terms of what is the degree of agreement on general questions and disagreement on matters that might "only be important to connoisseurs", is far more important than the training and activities of intermediaries.

C. The Experience of the Abstracting and Indexing A & I Services

There is a whole industry that has developed around the notion of providing "current awareness" (i.e., the most up-to-date information) to policy makers, practitioners, and researchers. Since these users cannot be expected to keep up with all the available knowledge, there should be some abbreviated way in which they can become aware of the information resources available. Given this perceived need, many groups have developed which provide abstracts of articles, tables of contents for journals, and some abbreviated review articles. These services are sold to government agencies, universities, and private practitioners.

These services have suffered from the assumption that this type of synthesis is central to scientific communication. The A & I services have found it difficult, if not impossible, to change patterns of scientific communication through simple data reduction--not withstanding the fact that it is done efficiently with the use of computer technology. They have had difficulty in attracting users and showing them that it saves them time and provides a real tool to them.

There are several important reasons why the A & I services have had difficulty in attracting users: (1) For the majority of users, a good review paper is more useful than potential access to a special knowledge base. These systems cater to the few who don't need it anyway; and (2) As a result of this limited market

and the continued wide distribution of the A & I products, there is further potential for overloading the system--especially with pre-determined and pre-digested products that the users have had little part in influencing. These two factors are symptomatic of the basic difficulty associated with A & I services: their inability to provide a differentiated judgment with respect to the available materials. Users of these services frequently complain that the data reduction problem is not really solved. While some really applicable materials is provided to them, they are still presented with a good deal of inapplicable and irrelevant material/knowledge (i.e., system overload).

In terms of thinking about the synthesis component of the RDX system, one must also remember that indexing is the beginning of a process, not the end. Indexing simply helps to organize data so that the filtering process, according to agreed-upon categories, can be initiated.

D. The Use of Intermediaries and Knowledge Utilization Agents

As already noted much of the literature in this area has contended that nonutilization and application result from a lack of fit between the research community and potential users. Thus, linkages need to be created which will bridge the gap between the two communities. To meet this perceived need, intermediaries (in the form of individuals and agencies) have been created. Within the context of the literature, these intermediaries have become known as knowledge utilization agents. Individuals and groups have taken on this task and have applied the traditional assumptions--especially those related to knowledge specific characteristics--outlined earlier in this paper.

To be sure, the knowledge synthesis process sees itself in the position of being able to provide this crucial linking role: (1) since individuals are

used to communicating through other individuals agents can provide the traditional communication channel; thus, syntheses can be produced and communicated by individuals; (2) individuals can be trusted. There is a substantial body of research which suggests that knowledge is likely to be used more often if it is communicated through a trusted agent. Individuals possess the capability of building relationships based on trust. Simple written materials cannot provide the same basis of trust in the absence of being communicated through an individual or group. Radnor, Spivak, and Hofler have pointed to the importance of trust in their work on educational policy and practice.

This notion of emphasizing trust is based on the belief that who passes on information is more important than the substance of what gets passed on. The State Science Policy Advisor system, for example, is based on a commitment to this belief. Although it would be possible to produce, process, and disseminate information relevant to policy makers and practitioners in the absence of a trusted individual--especially with the availability of computer technology--many states have hired formal advisors because of the crucial linking role they can play.

In thinking about synthesis within the context of the RDX system, we think the role of intermediaries may be a crucial one. An intermediary needs to be able to ask potential audiences the questions which will lead to producing relevant and meaningful syntheses. The intermediary can be especially useful in fulfilling the following functions: (1) understanding the client and researcher needs, constraints, and expectations; (2) acting upon these constraints by asking the clients questions and following a process (to be outlined later in the paper) which will allow for efficient data reduction; and (3) in fulfilling the other two functions, actively promoting changes in behavior and attitudes among researchers and clients. In this sense, knowledge synthesis is truly a consensus-seeking activity.

E. Mediphone

Intermediaries are extremely costly in terms of the allocation of human resources; problem solving is based on individual communications and the ability of the intermediary to supply "relevant" information. As might be expected, there have also been some experiments to institutionalize intermediary services so that so much reliance need not be placed on individuals.

By subscribing to Mediphone (based in Chicago) any physician or specialist may phone up with a problem; the trained intermediary on the other end of the line will consult his/her files and give the physician/specialist the name and phone number of a specialist in the area he is concerned with. While the physician is waiting on the line, the intermediary (operator) will attempt to contact the specialist. If contact is made, the two parties can talk to each other. If contact is not made, the operator calls another equally qualified specialist. Similarly, if the physician is not satisfied with the information he has received, then he can request another name of another expert.

The fee for this service depends on the number of calls that are made per year; the basic fee is based on four calls per year. Practitioner and research experts are both available through this service. It is important to note that this system relies upon the ability to locate experts and to know that they will be recognized as such in the medical community, as a whole. As already pointed out in our discussion of Glaser's method, there are problems with transferability of this assumption in education.

In terms of synthesis and the RDX system, it should be remembered that: (1) this type of knowledge transformation can best be characterized as providing support services. As such, it is not a total answer to the information problem by itself. Furthermore, this type of brokerage service was not traditionally thought of as

knowledge synthesis; and (2) the ability to use this service effectively depends upon knowing exactly what one's problem is. If one is not able to specify the problem, then the use of Mediphone is a waste of time and money; as such, it may provide some incentive to specify problems clearly.

F. Science Writers for Education

In the physical sciences and some very technical areas, experienced writers have been hired to translate research findings into language that will be understood by laymen. In this sense, science writers serve as a different form of intermediary between producers and users of knowledge. There have been some proposals to experiment with this idea in the field of education.

In considering this type of experiment, it should be remembered that (a) science writers can only be successful as the material that is provided to them; (b) writers do not specify problems or make them relevant to particular users; instead, they merely translate what is given to them into a product that is easily understood; and (c) science writers do not provide a framework into which to organize complex data. Thus, science writers could only be employed after most of the knowledge synthesis process was already completed.

G. Information Hot-Files

Another institutional form of the intermediary mechanism is represented by the information hot-file. Havelock, who first formulated this idea, was concerned with providing a service in situations where a live intermediary was absent. He formulated this idea with the goal of reducing redundancy in information collection and processing. He also wanted to reduce the amount of time it takes to access information. In constructing such a file, it allows one to search through a central file before going any further; hopefully, this file will contain the information that is appropriate and necessary for the client.

The key to understanding this innovation lies in the statement: It will hopefully provide the information appropriate for the client. The knowledge synthesis process must seek to insure for the production of products that meet client needs, with a great degree of certainty.

H. The T.V. "Station Break"

Another form of intermediary service which has been suggested in the field of educational R & D is the T.V. commercial. The Department of Education in the State of California has used the "54-minute station break" quite successfully. They have presented problem and solution oriented programs to the public.

It has also been suggested that this same method might be used to present synthesized data to the public--perhaps of the type suggested by Gene Glass.

Although this method has attractions in terms of working on presentation, its effective use is based on several assumptions: (1) there is an audience for such a program; (2) that the material could be general enough to attract a wide audience and specific enough to really be of help in solving problems; and (3) the mode of presentation will make a critical difference in terms of its ultimate impact.

It is our belief that mode of presentation is important in predicting ultimate impact. However, as with other methods already discussed, the T.V. station break will not specify problems or organize data into a framework that addressed client problems.

I. The Social Indicator Movement

This notion of meeting client needs with a great degree of certainty was in the forefront in the development of the social indicator movement. Social and economic indicators were developed with a keen appreciation for the information overload problem (as it is traditionally perceived) and the data reduction needs which follow from it.

With this keen appreciation in mind, social indicators were developed as potentially "high powered" sources of information that should provide clients with a large amount of relevant information quickly. However, this data reduction activity is differentiated from all the others reviewed thus far. These indicators were designed to measure progress toward programmatic goals and policies. However, these national goals were to be agreed upon (a level of consensus) by potential users of this information.

The social indicator movement did not realize its potential because the information was being presented with respect to a set of goals over which little agreement had been reached. In addition, the goals were so general and vague as to be relatively meaningless to many potential users.

However, in terms of the knowledge synthesis processes being advocated in this paper, the social indicator movement was designed correctly. True data reduction can only take place when there is a high level of consensus with respect to general programmatic goals. Subgoals and individual goals can then be ordered in relation to the agreed upon overall objectives. The potentially powerful source of information may be realized through the knowledge synthesis process.

In order to effectively judge whether information is "of value", commitments to specific priorities and goals (at each level of the RDX system) must be in place. With these in place, it will be possible to judge what information will contribute most effectively to the problem being faced by a particular client. Indeed, an intermediary, knowing what these goals are, can play a significant role beyond simply transmitting information. He/she can specify how that information will be used and what resources should be devoted to collecting it, given the relative priority position of the goal it relates to. If the goals and policies are not clearly stated, understood, and/or agreed upon (consensus), then

it is difficult to construct criteria for judging value which will be generalizable across different areas within the educational policy arena. Alternatively, information can be of value if it contributes to the intermediaries' and clients' ability to be able to specify priorities and goals. Both the process of setting goals and the actual commitment to them--in terms of structuring synthesis activities around them--points to the necessity of formulating a process for specifying value.

V. The Process of Specifying Value

It is fairly clear from the literature that knowledge synthesis has been thought of as a fairly passive process: it responds to problems already defined by assembling knowledge related to that specific problem. The process has not been used to help specify the problem so that the search effort can be more specific. Similarly, it has not been thought of as an interactive process whereby the person responsible for the synthesis makes judgments concerning relevance and value. As a result, most frameworks developed for syntheses have been descriptive and not analytic. Thomas provides an example of how those responsible for knowledge synthesis create a framework. Material is usually broken down into categories:

1. Material directly applicable for action
2. Material applicable for complementary action
3. Material hypothetically applicable for direct action
4. Material hypothetically applicable for indirect action
5. Inappropriate material

An interactive synthesis process would encourage actors to separate material into categories. These categories should, however, be based on judgements concerning information value.

Ideally, the responsibility of officials at all levels of the RDX system should be to engage in a continuous exercise to establish overall system goals, sub-program goals, and to develop priorities and implement them. Failure to continue to perform this exercise results in excessive information production in the form of knowledge syntheses. The absence of precise objectives breeds ambiguity, misunderstanding and redundancy.

The following simple construct could be of assistance to participants in the RDX system. Information is valueable if it contributes to the well-being of students AND if it is useful to the teachers of these students. Both parts of this statement are essential. It is not sufficient to be useful to teachers (it is a necessary condition); however, if this useful information can then be applied in such a way so as to lead to student-well being, then we have procured information which should be considered as being valueable. This may seem to be obvious and too general a definition to be useful, however, it is unsettling to see how many large information systems and programs developed in the educational area do not qualify under this criterion. All too often administrative concerns, rather than educational benefits, underlie information programs.

Clearly, it is difficult to develop operational measurement tools for such a general standard as: RDX related information is valueable if it contributes to student well-being AND is useful to the teachers of these students.

However, it is possible to outline a process which can be followed to formulate a set of concrete questions aimed at constructing criteria for judging value. In adopting this approach, we realize that specific criteria may change over time and that there may be some goal conflicts; however, one is still left with a basic set of questions and procedures for specifying value.

Specifically, information is valuable if, and only if (1) it influences or leads to policies that increase student well-being, while being useful to the teachers of these students; (2) it is essential for answering current policy questions; and (3) it has some beneficial, documentable effects for the students that the RDX system is committed to serve.

In the case of this information system, "student well-being" must be linked directly to programs and policies which some identifiable and articulated educational need. Operationally, information related to student well-being might be conceptualized in the following manner:

1. Information has value if it contributes to implementing, operating, and monitoring programs which are responsive to student, teacher, and educational needs.
2. Information has value if it contributes to legitimate regulatory responsibilities of educational agencies and/or policy-makers.
3. Information has value if it assists the educational community in understanding, evaluating and implementing their programs or in determining whether educational institutions (including governmental ones) are acting appropriately; and
4. Information has value if it assists the educational community in obtaining the goods and services to which it is entitled.

There are also sub-optimal definitions of information value, which may or may not be directly linked to realizing student well-being:

A. information which contributes to the effective operations of an educational agency
B. information which is collected in a cost-effective manner
C. information which introduces a new idea or innovation into government.

D. information which helps an administrator/policy-maker justify his/her program or record of performance.

E. information which helps to assess public reaction to policy options being considered by educational policy makers.

F. information required for the internal administration of a program.

These alternative, sub-optional definitions of value are not directly tied to contributing to or providing for student well-being even broadly defined; instead, they relate to significant and often legitimate functions of government and private organizations, internal management, agenda setting, cost/benefit considerations and justification and legitimation to one's superiors.

A. The Need for Specifying Goals and Priorities

If it is true that information has value if, and only if, it contributes to student well-being and is useful to teachers of these students, the process must start from a continuing interactive exercise which: identifies goals, establishes priorities among these goals and develops sub-goals.

Information value can then be expressed in terms of the extent to which it relates to realizing a goal. Relative value can be judged in terms of relatives degrees of priority. Once it has been shown that a particular problem is related to a specific goal and priority (hierarchially ordered), then one can begin to think about types of information that are relevant to it.

Information is frequently considered to be "of value" if it is used; but this must be questioned. It is necessary to start with student well-being as a goal and then use an information process as a means to achieve this end.

In short:

What is needed:

Student well-being ⟶ process ⟶ educational benefit

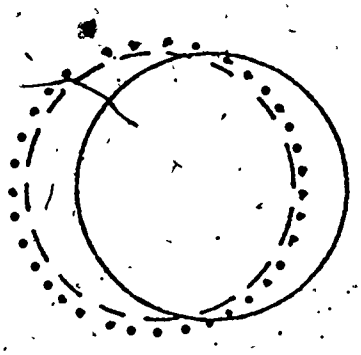
What is not needed but often occurs:

Power objectives ⟶ process ⟶ information fiefdoms or overload

Conceptually, it is possible to think of three types of information activities relevant to the RDX system: information collection, information use, and information value. The effectiveness of the RDX system can be judged by the congruence of these three activities.

Intermediaries within the RDX system should strive to insure that the information collected and/or processed through the RDX system is used AND that the information collected (processed) and used is valuable. A model of a highly effective RDX system is illustrated in Figure A.

FIGURE A



LEGEND

..... Information Collected

– – – – Information Used

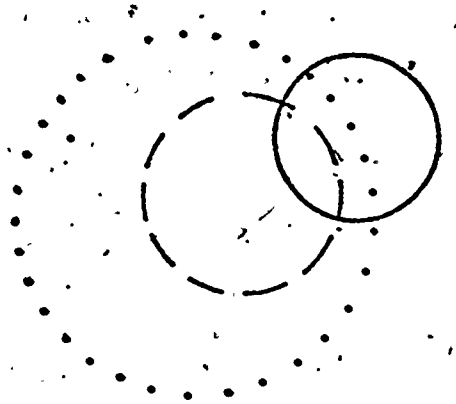
——— Information of Value

Thus, information of value is almost the same as (congruent with) information used. Slightly more information is collected than used.

A [redacted] typical situation is represented by Figure B. This is the situation at the fo[redacted]dation of the proposed RDX system. Far more information is collected than needed. Frequently also, as represented in the figure, more information

is used than is truly relevant (of value). This is, for one or two reasons, either because there is actual or perceived potential disagreement on what information is relevant; alternatively, the relevant information is not available and hence it is necessary to fall back on a set of supportive proxies.

FIGURE B



LEGEND

Information Collected

Information Used

Information of Value

B. Specifying Information Value

As we already indicated, it is important to outline a process which can be used by intermediaries in specifying information value. The intermediary serves a critical function in understanding client and researcher needs, and in providing for these needs. Those engaged in the process of knowledge synthesis provide for information needs that are of particular relevance to those requesting the information. In providing relevant information, those engaged in synthesis avoid the charge of contributing to the information overload problem. Relevant syntheses do not just add to the stock pile of available information in any given problem area.

If knowledge syntheses are to provide a valueable service within the context of the RDX system, we propose the follow process:

Step 1: Each information request from a state official, local official, or school practitioner be processed by an intermediary responsible for preparing the synthesis.

This intermediary would ask the following questions before providing any information:

a. Which program, goal, or priority does the information you are requesting relate to?

b. What information have you been exposed to in this area?

c. In what ways would this information be essential for your problem-solving activities?

d. How do you intend to use the information?

Justification:

As already noted earlier in this paper, we conceive of the synthesis process as a consensus seeking activity. It is also essential to note that a synthesis is not a passive process; it requires interaction between those producing, processing, and using information/knowledge. Thus, the intermediary producing knowledge syntheses must be certain that he/she understands organizational goals, policies, and priorities in the same way that the potential user does.

In addition, the first question is also a check on the potential user's ability to clearly formulate an issue/problem. "Information overload" is commonly thought of as resulting, at least in part, from vague goals and/or vague guidelines for gathering and/or processing information. The intermediary should not guess about the problem of concern to potential users. We are aware of the fact that many analysts studying research and development issues contend that successful knowledge producers must allow policy guidelines to emerge from their work. It is, however, our strong conviction that the problems associated with current synthesis activities and practices are closely associated with the lack of clear goals and priorities and/or lack of consensus concerning the goals that educators should be striving to achieve.

Moreover, with relatively clear goals in mind, the intermediary responsible for knowledge syntheses has a clear standard by which to judge what to include and exclude from the summary being created as part of the RDX system. This is the type of standard that can be applied to the situation often cited in the literature on knowledge synthesis as an obstacle to utilization:

TYPICAL SCENARIO: Decision maker X is faced with the problem of adopting a track system or other system for placing students in grade school. His own intuition is to adopt the track system. Having just been introduced to the concept of searching for the best information available in this area, he instructs his assistant to assemble this information for him.

Having received the vast amount of information available on this subject, he begins to sort though it. Upon closer examination he finds that there are two conflicting schools of thought. One group is for the tracking system and the other is against it. Further, the decision maker discovers that the information/research is of equal quality. Both sets of information are in a form that can be easily understood by the decision maker.

Given this situation the decision maker is not helped by consulting the available information. His uncertainty is not decreased. Logically, therefore, the decision maker adopts the course of action that was intuitively acceptable to him in the first place.

With goals in place (at least at the level of understanding between knowledge producers, users and intermediaries) the intermediary can process the available information by applying the following standard: does it relate to the goals being maximized; what priority does the goal have in the overall scheme? The answers to these questions provide clear criteria for purposes of information processing:

a. If the information relates to the goal being maximized, then the information should be highlighted in the synthesis.

b. If the information relates to a <u>high priority</u> goal, then the synthesis should reflect this fact.

Within this context, we are not suggesting that this system be used for political purposes; i.e. excluding information which does not relate to a goal or which contradicts a goal set out by a group of policy makers. On the contrary, we would conceive of the following scenario if our system were to be adopted:

Non-Traditional Scenario:

Decision maker X is faced with the problem of adopting a tracking system or other system for placing students in grade school. He instructs his assistant to assemble the available information on the subject.

The assistant then goes to (phones) the intermediary in the RDX system responsible for dealing with decision makers and practitioners. The intermediary proceeds to ask the questions specified in Step 1 of our recommended process.

In talking with the assistant, the intermediary discovers that the school board has mandated the decision maker to produce the best overall reading scores of any school in the area (or at least better than the students are currently performing).

Having discussed this goal with the assistant, the intermediary discovers that the school board has discussed two possible options: tracking and random placement in classrooms. The reason for discussing tracking, however, is solely related to the board's interest in increasing reading levels.

With this information in place, the intermediary is able to search for information on how reading rates relate to improved reading scores and other academic abilities.

Having assembled this information, the intermediary can then present arguments related to specific issues: how do different placement systems affect reading rates? Also, the intermediary should be expected to provide information on unanticipated consequences of adopting these options. The intermediary should also be expected to discuss the goals and problems with the potential user. For example, if he is interested in increasing reading rates, then it may not be appropriate to look at tracking systems. However, the intermediary would not be in a position to make this type of judgment if it were not clear what the decision maker was interested in; i.e., not just a general evaluation of tracking systems, but an increase in overall reading rates.

In terms of understanding how our proposed process might work, it may be useful to present another scenario:

Non-Traditional Scenario II:

Decision maker X is concerned with reading levels/rates of students within his school system. He goes to the intermediary in the RDX system and says: What are the best methods available for improving reading scores/levels?

The intermediary should then respond by saying that if you are interested in the best methods, you are likely to find that individual diagnostic one-on-one tutoring teaches more kids to read better. However, this system is very expensive. Other methods work less well, but work for 60% of the kids. Do you really mean to ask for the best method or the one that will work best in the classroom; i.e: will work for the most kids efficiently and at a reasonable cost?

The decision maker then answers that he is really interested in classroom applications.

The intermediary is then able to search for the information which is within the budget of the school and can be applied to classroom situations.

In terms of understanding our proposed system for synthesis, we would highlight several differences between the two scenarios outlined above:

A. The first scenario reflects the typical synthesis process. The intermediary is given incomplete information on how the question being asked relates to the overall policy context/environment. Our proposed system is dependent upon ascertaining this information before proceeding any further.

B. The first scenario requires more resources and produces many more citations (more information overload) than our proposed system. The first system produces all information related to tracking any other options. It is then the job of the intermediary responsible for the synthesis to sort through this information and present it in some logical framework. In the proposed system, the intermediary can afford to be much more selective; only the information which relates to the association between the tracking system and indicators of academic ability are processed. In addition, by processing information in this way, the intermediary has a ready-made framework to organize the assembled information.

C. The first scenario accepts the assumption that the synthesis process is basically a passive one. It simply provides the user with all of the knowledge available on a given subject. This is a process that can be completed relatively quickly with little front-end investment of time on the part of the user. However, once the product is completed he may have to spend a great deal of time sorting through or ultimately deciding that it is not worth his/her time. Our recommended process requires an investment of time in the beginning which we believe will pay off when it comes to using the synthesis.

D. Our recommended process assumes that in order to participate in the synthesis process skills must be developed by intermediaries, users, and producers of knowledge. The traditional process does not make any assumptions about skills. Specifically, skills are required in the area of specifying problems, and being familiar enough with the literature and the problem-solving process (of administrators, policy makers, and teachers) to give appropriate guidance to potential clients.

Given this background concerning the goals of our proposed system and its advantages, we are ready to continue discussing the process which can be used to realize these goals. The reader should be cognizant of the fact that question #1, outlined in Step 1, merely serves to delimit the universe of information that might be relevant for a given synthesis.

Given this initial step, the intermediary can then move on to define the user's knowledge and experience with respect to the problem at hand. The answer to this question provides the intermediary (question 2, Step 1) with essential data on the level of sophistication to which the synthesis should be oriented. If the user has some background in a particular area, it is not necessary to include much of the basic material. A principal, for example, knows what the key

issues are in increasing the reading speed and comprehension of elementary school students; he is, however, concerned with the success of various methods used and tested. If the intermediary is not successful with ascertaining clear problem definitions, then this question provides additional information which is essential for "focusing in" on the problem at hand.

The third question (Step 1) begins to narrow the universe for purposes of creating the synthesis product. If the information is essential for solving the problem at hand, then the potential user should be able to tell the intermediary (a) what he would do if he does not have the information; and (b) what trade-offs the user is willing to make in order to receive this information. Information should not be viewed as a free good. Often an information system like the RDX system leads users to the mistaken belief that it "would be good to have all the information available through the RDX system." Current synthesis practices have simply made it easier for users to be exposed to all this information. Our proposed "interactive process" is designed to eliminate this practice. If the information is not essential and if trade-offs are not being made, then the synthesis shouldn't be provided. Users should be worked with until this type of calculation can be made.

Finally, the last questions also check on the precision of the information request and the need for it within the requesting organization. In all likelihood, if a user cannot tell an intermediary how a synthesis will be used, it is not essential for solving the problem at hand; lack of planning also reflects a tendency to search for all information instead of information related to a specific problem.

Step 2: Having established the need for a synthesis, the intermediary is now prepared to specify critical

details related to the form and other characteristics of the synthesis to be produced.

a. How many people will be receiving this synthesis?

b. What is the background (demographically) of the groups for whom this synthesis is being prepared?

c. What format have you received such information in previously?

d. What format are you most comfortable with?

Justification:

Again these questions are designed to create a spirit of cooperation and coordination between the actors involved in the knowledge inquiry process which is part of the RDX system. Specifically, these questions are designed to increase the utilization of relevant syntheses by taking formatting and dissemination considerations into account "up front."

By specifying how many people (organizational sub-units) will be receiving any given synthesis, the intermediary is establishing the essential ground-rules for purposes of formatting. If only a few people (especially within one organizational sub-unit) are receiving a synthesis, then it can be tailored to their specific preferences and needs; on the other hand, if a large audience must receeive such information in a form which can be equally well understood and used by all, then "tailoring" must be kept at a minimum. In the latter case, the intermediary must search for the lowest common denominator.

Similarly, by establishing the diversity of background characteristics of the potential users, an intermediary is also able to determine the extent to which a synthesis can be oriented toward one particular group. The same principle applies: the more diversity, the less the intermediary is able to

tailor specific products. Within the context of the RDX system, we expect that intermediaries must be prepared to produce both types of products.

Having established the size and background of a potential user audience, an intermediary is now prepared to make critical decisions concerning the form in which the synthesis will be presented. Users not familiar with computer techniques, for example, should not be presented with "computer read-outs" as their first synthesis product. Similarly, those accustomed to written materials (as opposed to tapes or films or conference calls) should initially be provided with information via their preferred media form/mode. Subsequently, once users are demanding more relevant and valuable synthesis (reflecting the interactive process outlined above) they may be exposed to other media forms which may be more cost-efficient than the traditional methods they are accustomed to. Users may also find that non-traditional media modes are also time-efficient in terms of receiving up-to-date information, quickly.

Step 3: Having established the universe of applicable, relevant information and having established formatting criteria, intermediaries are prepared to produce the synthesis requested. In the process of creating this product, certain key questions must be answered by the intermediary:

a. Do I fully understand the problem being faced by the potential users of this information?

b. Do I understand the information they are familiar with and what information they can obtain from other sources?

c. Am I or others in my organization fully conversant with the information related to the problem at hand?

d. If not, can we get the necessary information in a short period of time and/or put our users in contact with experts who are familiar with their problems?

Justification:

Intermediaries must be fully cognizant of the fact that they are being tested at the beginning of an experiment like the one represented by the RDX system. If they do not establish their credibility at the beginning of their exposure to users, then they are likely to lack credibility throughout the life of the system.

As Caplan (1975) found, users are very receptive to new information. However, high-level policy makers complain that they are not being exposed to the best quality information. We already noted the importance of distinguishing between information overload in general and an overload of relevant information. Furthermore, users are tied to the information channels that they are accustomed to using. Thus, to break into this market, information producers must immediately prove their value to potential users.

This set of questions emphasizes the importance of thinking of knowledge synthesis as a consensus seeking activity. The production of valuable information is dependent upon clear understandings and mutually accepted expectations. Moreover, intermediaries are not trying to fool anyone. If the necessary information is not available, then it is their job to put users in contact with experts who will be able to provide timely information. Similarly, even though we do not believe that "quality" is the primary criteria for judging whether information should be included in a synthesis, it is not a criteria to be ignored. Quality information is available on different sides of a question. However, once a mutually agreed upon framework is in place, quality is an important consideration.

a. collated knowledge (using some media form)

b. names of individuals to be contacted

c. a general assessment of available information in the problem area (scope, quantity, quality, etc.)

Ths notion of expanding the scope of knowledge synthesis to include a network is consistent with our argument that synthesis should be conceived of in terms of diffusion of innovations models. With a network in place, one can logically expect (over time) sharing of information and consultation which by-passes the intermediary. Participants in the network will get to know themselves as well as the intermediary. Hopefully, this will encourage knowledge inquiry systems which extend beyond the narrow boundaries of current practices.

Step 4: Having provided the synthesis, follow-up should occur within three months of the time it was received. The intermediary should use the following questions to guide this proposed stage of the knowledge synthesis process:

a. How was the synthesis used?

b. Was it used in the way you intended to use it?

c. If not, why not?

d. Were you satisfied with the relevance of the information?

e. Which other users might want to know about this information?

f. Are you willing to talk to others about your experience?

Justification:

These questions serve to guide the intermediary in improving the quality of service provided to potential users. Empirical studies in the area of research

utilization indicate that one can expect initial utilization of information within three months of the time that it was received by the using organization. Thus, we suggest the three-month timeframe for initial follow-up activities.

It is essential to establish if the information was/is being used in the way in which users originally intended to use it. The correlation between intended and actual utilization will serve as an indicator of how well the user has planned for incorporating information into his decision-making needs; it will also show the extent to which information is related to programmatic goals that were established prior to acquiring any information. Within this context, it should be remembered that use can be found for any information, if continued budgetary allocations are dependent upon it. Thus, use by itself reveals very little about the "value" of the information being produced. If intermediaries are expected to provide information that is considered to be "of value", then they must receive feedback on use and be in a position to compare actual and intended uses.

If requested information in the form of a knowledge synthesis was not used for its intended purpose and/or not used at all, then the knowledge synthesis process was not successful in its consensus-seeking capacity. This type of feedback would be symptomatic of the need for better interactions between the actors that are part of the RDX system. The answers to the other questions concerning format and style will help to improve the overall quality of service available through the RDX system.

It is, of course, the case that use may also be affected by the political and organizational environment (see the Gross and Mojkowski papers prepared for RDX participants). Politically, plans may be very clear and impossible to implement. Organizational barriers may well stand in the way of implementation.

Summary:

The proposed four-step process is designed to guide the knowledge synthesis process toward the goal of producing valuable information which is reflective of sound management techniques/principles. The four steps cover the essential steps in problem solving of concern to managers: (a) problem definition, (b) information production, (c) information use, and (d) feedback and evaluation. It is our conviction that this process should be used for all actors who are part of the RDX system.

Discussion:

We have put forward an information management system that can be applied by intermediaries responsible for knowledge synthesis. It is directly responsive to the traditional assumptions made in the knowledge synthesis literature:

Assumption: There is an information overload problem. Knowledge synthesis should be designed primarily to reduce the overwhelming amount of data being disseminated to policy makers, practitioners, and administrators.

Response (on the basis of our system): There is not a general information overload problem. Those responsible for synthesis have not distinguished between relevant and irrelevant information--thus, there is the appearance of overload while policy makers still complain of not being exposed to the best quality information. Through our interactive process, users will be in a position to specify their specific needs; the intermediary organization will provide for them.

Assumption: The age of the computer will help solve our data reduction needs; through the computer this can be done quickly and users can be exposed to large quantities of data in a form that can be easily assimilated.

Response: Data reduction be itself does not help solve the problems at the foundation of current synthesis practices. Thus, not even the best and most advanced technology can specify problems or formulate foundations for concensus. These foundations must be formed before technology can be of aid to us.

Assumption: Scientific communications have always been part of the knowledge synthesis process. Thus, users will naturally be receptive to utilizing syntheses.

Response: Scientific communication has always been dependent upon one-to-one communication. Scientists would consult with a colleague before using an A & I service. The interactive synthesis process builds this reality of scientific communication into its design.

Assumption: The information business has always believed that if they can produce a product that is easily understood and timely, users "would beat a path to their door to take advantage of it."

Response: Consumers do not feel that they have to develop a strategy for collecting and processing information; instead, information will simply be disseminated to them--irrespective of any special, well-formulated request. This type of dissemination has always occurred in the past. Furthermore, communication processes over the phone make is easy to rely upon personal communication. In conceiving of the intermediary role as critical, we have taken this reality into account.

Assumption: Utilization of knowledge synthesis products are not occurring at the level they should because they are not timely enough, they are not in the proper form, and they are not of high enough quality. If these barriers can be overcome, utilization will automatically follow.

Response: Unfortunately, the barriers to utilization are not this simple solve. There is good empirical evidence to show that even when these factors are taken into account, utilization does not follow. Thus, use is not a good proxy for value. Working within the framework and mind set of users has a better chance of producing utilization.

In other words, we are proposing this system in an effort to move beyond the traditional linkage models that have defined the boundaries of knowledge production and application since 1945.

Ideal situation vs. reality:

Ideally we would like our intermediaries to serve a coordinating role between various users within the RDX system. This type of coordination would involve the following functions:

A. If a principal asked for a synthesis oriented toward one policy or goal and a superintendent toward another, the intermediary could say that they are working with conflicting goals within the same school district.

B. Similarly the intermediary could advise actors that they should strive for better coordination between programs.

C. The intermediary could in a sense serve as a policy advisor or aide to all actors. He would be aware of their activities and could advise people of conflicts and management inefficiencies.

In this type of ideal situation, the intermediary would be responsible for facilitating a goal-setting exercise which would serve to rank-order priorities and goals among all actors in the RDX system. From a management point of view, this would guide all actors in terms of resource allocation and agendas for problem solving.

Even though this would be ideal, we do not feel that it is realistic for the initial stages of the RDX system: (1) intermediaries cannot be in the position of appearing to manage or manipulate the clients/users' agenda; this would be politically naive. Intermediaries may have to initially provide information before engaging in the give-and-take which is essential for the process of specifying value; and (2) by initially concentrating on one-to-one interactions which attempt to specify problems and goals, one can work up to trying to specify goals at the level of the RDX system as a whole. Although information overload related to conflicting goals will not be eliminated through the adoption of our proposed process, consensus can be achieved within single organizations and groups of users.

C. Constraints and Problems Associated with the Process of Specifying Value

In addition to the political and organizational problems facing the synthesis component of the RDX system, several other problems are of immediate concern:

(1) The intermediary is not working with the teacher or other client directly. He is working th[illegible]h several other layers and relying upon them to relay his request. Although this is particularly troublesome at the beginning stages of the RDX system, this type of forced communication will help to build up a network and commitment to the process over time. Commitment of representatives at all levels of the RDX system is essential if this system is to work. Operationally, RDX intermediaries would be

asking the clients' intermediaries questions. Presumably, these questions would have to be transmitted back to the client, before an information request was to be filled.

(2) As already noted, this type of communication requires skills and training. The level of sophistication to make this system operate successfully will only be built up over time. Initially, RDX intermediaries are not in a position to say, "I won't provide you with any information unless you engage in this process." Such an intermediary would be considered unresponsive and uncooperative.

(3) However, the intermediary is in a position to create a need (in the eyes of the clients) for providing this information; e.g., by informing the client's intermediary of the alternative interpretations that can be given to a particular question, and the different kinds of information that would be provided for each alternative. In this way, the importance of problem definition can be appreciated.

(4) It follows from this that intermediaries and clients must value the training that they will receive as part of the synthesis process. This might be done through some quasi-experiments. In cases where clients insist on receiving information without going through the process of specifying value, the information should be provided. When a similar problems comes up from a client that will cooperate by engaging in our proposed process, the original client should be sent a copy of the material produced through both searches along with an analysis of the resources (time and money) devoted to each. Presumably, this will help to create some level of demand on the part of the user who was reluctant to engage in the process of specifying value.

(5) Our recommended process for specifying value also faces the potential problem of producing many idiosyncratic syntheses. To what extent could these syntheses be usefully (appropriately) replicated over time? It is our feeling that this is only an immediate problem in the early stages of system development. Over time, users will come up with similar problems. Intermediaries will then be in a position to say: "Person X had a similar problem recently. Let me send you the materials he received. Also, why don't you contact this person to find out what his experiences were. If these materials are not adequate, call back and we will see to it that you are provided with what you need." Gradually, we expect a bank of packaged materials to accumulate. Also, organizational memory will develop to the extent of being able to serve the support and training function critical for the success of the knowledge synthesis process.

VI. Staging and Phasing

Clearly, some thought needs to be devoted to implementing this system. This paper, as a whole, is written with a vision of the ideal, full knowledge synthesis process in place. In terms of staging and phasing, the following points should be kept in mind: (a) initially, the intermediaries will play a key role; they must implement the four-stage process; (b) gradually, organizations will begin to build an "organizational memory"; (c) this will enable organizations to begin to build an informal network--where they are drawing as much upon their own expertise as those of the intermediaries; and (d) eventually, network members should be in regular contact with each other for purposes of specifying questions/problems "at hand" and for collating synthesizing information. Eventually, the role of the intermediary should be

to provide occasional assistance (of a technical nature). The RDX system (in the long run) should not be dependent upon this special class of experts.

In thinking about implementation more specifically, we feel it is useful to talk about the individual and systematic level; i.e., what can individuals do, and how will this affect the system over time? We also feel that it is useful to think of the whole implementation process in the framework of diffusion of innovations (see Zaltman and Sikorski for a more general statement of these problems); as more and more people become familiar with the synthesis component and the process which accompanies it, commitment will be built up. The overall perspective on staging and phasing for the RDX system is spelled out in the paper by Bean and Rogers.

The implementation process can also be thought of in terms of the feed-forward aspects built into the RDX system. Specifically with respect to knowledge synthesis, intermediaries will be providing the feedback which will provide the groundwork for the next stage of development. Eventually a user/client oriented system will be continuously in the position of developing the system.

On a step-by-step basis, the implementation of the synthesis component can be thought of in the following manner:

Step 1: Establishing communications between RDX intermediaries and other levels of the system

a. system level: Several packages on subjects of national importance should be prepared by the intermediary organizations (e.g., issues like competency standards for graduation, how to deal with a consolidation plan, bi-lingual education, how to manage teacher contacts with students, increasing reading and writing abilities). These packages should be oriented toward the key issues in each of these areas--what problems are of most concern? How can they be dealt with in the context of a

school system and limited resources? These packages should also contain frank statements as to what is known and unknown in a given area of concern.

b. individual level: Where problems come up that are related to the pre-prepared packages, intermediaries should attempt to engage users in the process of specifying the problems and goals they are working with. In cases where packages are not available, clients should be put in contact with experts who would be familiar with their problem.

c. time line: Between 9 and 12 months.

d. justification: The system will not be able to handle all requests efficiently at the same time. Since commitments to this process will have to be developed, it makes sense to develop a series of packages that can work efficiently for clients and users.

Step 2: On the basis of established communication, begin to engage participants at all levels in the system in the process of specifying value.

a. system level: New packages are constantly being developed and a memory bank of experiences with synthesis begins to become available. When feedback is received on a given product, the name and experience is stored. As a result, when a client comes with a similar problem, he is able to receive the synthesis product, the experience of others with the product, and the names of people who have dealt with this problem. In other words, organizational memory is being built up over time. These developments should also lead to a demand for synthesis products among participants.

b. individual level: As demand increases, it will be possible to build up the network of people engaged in the process of specifying value. We can conceive of two possibilities: (1) client intermediaries will engage in the process of questioning their clients; and (2) they will put the clients in direct contact with RDX intermediaries. Also, client needs will help to generate the ideas for more packages. At this stage of development, clients will continue to be put in contact with experts in areas where packages are not available.

c. time line: Between 18 and 36 months.

d. justification: Again, we want to be careful to build up support for this process gradually over time. At the same time, we feel that it is important to build up an organizational memory--both in terms of individual experiences and substantive knowledge. The system should also be in the position of continuing to update itself.

We distinguish the development of an organizational memory from the creation of a catalog. We do not simply want to provide users with a listing of packages that are available; this would again fall into the mode of a passive process. Instead, we want to engage them in the process of specifying their needs and responding directly to these needs in terms of providing substantive material, experiences of individuals who have worked in this area, and the names of these individuals so that they may be contacted.

The development of an organizational memory is particularly consistent with thinking of synthesis as the collation of literature and exemplary practices. The development of an organizational memory, as we have conceived it, is especially important in terms of reporting exemplary practices and the experiences associated with implementing them.

Step 3: The phasing-out of intermediaries in a critical, active role

After three years we expect the organizational memory to be developed to the extent of containing information--in terms of substance, experience with practice, and names of experts on most subjects of interest to clients. Furthermore, the up-dating will have been developed by this point in time. Thus, it will be possible to replace the trained intermediaries who must be involved with every exchange in specifying value with an operator who is trained in educational research and methodology (i.e., similar to the ones used in the Mediphone system). These operators will rely on the fact that networks have been built sufficiently for people to want to engage in the process of specifying value. These operators will be trained to guide users through this process.

VII: Critical Indicators for Monitoring

In terms of the development of the synthesis component of the RDX system, monitoring and evaluation are built into the system in several ways: (a) intermediaries are responsible for receiving feedback from users when a product is received and at three and six month time intervals thereafter; (b) the development of an organizational memory is dependent upon receiving feedback on how the information was used and whether "exemplary practices" were facilitated through

the application of the synthesis; and (c) the movement from step to step in the staging and phasing process is dependent upon careful feedback and evaluation. As the Weiss, et.al., paper on monitoring points out, the monitoring dimension of the RDX system (in general) is carefully tied to the feedforward aspects of this system.

Specifically, with respect to the knowledge synthesis component of this system, formal evaluation (in the sense of formative evaluation) should occur at the following points:

1. At the end of stages one and two in the implementation process;
2. One year into step three to see if the system is operating independently of the active involvement of the intermediaries.

VIII. The Synthesis Component and the Overall Themes of the Conceptual Papers

The development of the synthesis process is closely tied to the themes that have been used to integrate all of the papers prepared for RDX participants:

1. Problems specific to educational policy--since education is a derivative discipline; the synthesis process is affected; i.e. it is difficult to innovate and new methods are often resisted.
2. Interorganizational conflict and management--the entire synthesis process proposed in this paper represents a management approach for developing complex R and D systems. We are attempting to provide guidelines for the development of an efficient system which overcomes the barriers associated with effective development and use of knowledge synthesis products in the past.
3. Staging and Phasing--in terms of knowledge synthesis, we have developed several steps for implementation that can be thought of in terms of systematic and individual levels.

The regional development of this R and D system is not affected by the synthesis process advocated in this paper. It should be applied across all the regions; differences may occur with respect to the speed of implementation.

IX. Sub-Optimal Solutions

As indicated earlier in this paper, the process of specifying value represents an ideal solution to the problems of knowledge synthesis and transformation within the context of a complex R and D system. There are acceptable alternatives to this process. We strongly believe that each of these alternatives will not address the root causes associated with less than adequate traditional synthesis practices:

1. The Glaser approach for producing state-of-the-art papers. Clearly, this approach has the advantage of building consensus concerning the major issues in a given discipline. In addition, it sorts out the best quality information available in a given area.

   Disadvantages: However, in adopting this technique there is no guarantee that the synthesis will be related to the goals which the using organizations are mandated to maximize.

2. The Glass approach for producing meta-analysis through statistical analysis of numerous studies on the same subject. Clearly, this approach has the advantage of validating findings and putting differences between various researchers into perspective: are there siginificant differences or are the seemingly conflicting results due to insignificant variations in method or form?

   Disadvantages: However, this technique does not allow for the development of a common framework in which to place results; such work is left to the discretion of a particular user.

3. The social indicator approach used by OMB. This approach is designed to provide information on how well we are doing as a nation concerning the goals that OMB considers to be of national importance. In each synthesis, at least some goal-related information is being presented. Disadvantages: However, there is no guarantee that the goals that the OMB indicators are measuring have any relevance to the user being exposed to the knowledge synthesis. Again, an interactive consensus seeking process is missing.

We feel that all of these approaches have merit and at least try to maximize some of the goals that we are trying to achieve in our four-step system of knowledge synthesis.

Conclusion

Clearly, more work has to be devoted to operationalizing the system proposed in this paper. As a whole, the paper was written with a vision of the full knowledge synthesis process in place. We have attempted to provide a general step-by-step plan for thinking about and organizing the implementation process. Essentially, we have provided guideposts for what might be expected at the end of each stage of system development.

The notion of specifying the value of information and not thinking of use as a proxy for value is novel in the synthesis area. It goes against the general market paradigm of supply and demand. If there is a demand and there is use, why shouldn't we think there is value.

We believe that this framework and way of thinking is reflected in the "current state of the art". Thus, we have tried to provide a different framework in which to order knowledge inquiry processes.

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CHAPTER FIVE

IMPLICATIONS OF DIFFUSION RESEARCH FOR RDX

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Implications of Diffusion Research for RDx

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OVERVIEW

The RDx is carving out a role in a larger process, that of detecting practitioner needs and matching them against R&D resources, with the goal of providing more responsive research, development, and delivery. The diffusion literature offers a number of principles for the RDx in this endeavor. However, since much of the research deals with diffusing single or specific innovations, it must be interpreted cautiously. With this in mind, the following are offered as diffusion principles:

Planning facilitates innovation diffusion, and where planning is more explicit and detailed, diffusion is faster and more complete.

Diffusion planning should begin at the earliest stages of R&D, when decisions on the form outcomes will take determine their ultimate communicability, complexity, radicalness, advantage, and compatibility. Thus, close and meaningful interactions with intended beneficiaries should occur prior to development.

Diffusion planners should consider not just the nature of the beneficiary system(s), but also the relation of those systems with their environments. The diffusion process is blocked where it deals with innovations which are appropriate from the perspective of one but not both. This is particularly true if either is threatened or jeopardized by an innovation or change advocated by the other system. The greater the discrepancy between a social system and its environment, the more difficult it will be to diffuse innovations in that system.

Diffusion is more easily accomplished among social systems with many external linkages. However, different individual systems handle the adoption and change process differently. Reactive systems co-opt or preempt innovations; proactive systems adapt and incorporate innovations. The latter processes are more time-consuming, but are necessary for "ownership" of the change.

Diffusion of innovations within social systems is slower, but more sustained when the system has open internal communication flows. This is because open flows invite involvement from many or all levels of the system, and this involvement has the paradoxical effect of slowing the change process, but increasing the likelihood that it will be sustained.

Educational linkers should distinguish among the organizational change stages: initiation, implementation, and resolution. Different types of assistance are required at the different phases.

Educational linkers should be sensitive to the informal as well as the formal aspects of adopting organizations.

Educational linkers can work best with systems which perceive and understand their needs for change. Need assessment activities should be encouraged and assisted. A change agent should establish that there exists strong commitment to change in both the formal and informal systems of schools. Further, it should be ascertained that the system has or can acquire the necessary resources to accept and sustain change.

In planning diffusion, it is necessary to consider the variety of organizational roles in the beneficiary systems and to consider the different needs of each type of role. Roles include gatekeepers, opinion leaders, decision-makers, innovators, implementers, and affectees, any of whom can influence the diffusion process.

Diffusion planners need to consider where the various role holders are in the acquisition of their roles. A person's needs stem in part from role familiarity and experience. Individuals want formal guidelines and assistance at early stages; at later stages, they become more interested in having meaningful impacts in their roles and in personalizing their performances.

Early in a change process, participants are in early role-acquisition stages and need more formal, guidance-type information and assistance. At later stages, they may take more risk and become more "innovative" to achieve impact.

Diffusion is improved when there exist mechanisms for taking on new roles. These should attend to needs occurring late in role acquisition, as well as ones occurring early in role acquisition.

The diffusion process is conditioned by the available resources (innovations). In effect, poor products will not be successfully diffused. Some adaptations may occur, but this is not what is aimed at by an ongoing diffusion system. Rather, the system should, over time, match appropriate resources to user needs and facilitate satisfactory exchanges. These goals will be frustrated if adequate, satisfactory resources are not available.

Diffusion is easiest for innovations that are new. When "mature" innovations are being diffused, there exist more substitutes or competing innovations, and the remaining non-users tend to be segments least inclined to adopt.

The single most important attribute an innovation should have is flexibility. Diffusion is hindered when innovations being diffused do not fit easily with the variety of conditions characterizing adopting systems.

Choice of tactics for assisting the change process should reflect careful consideration of the decision stage to be reached; the tolerance of participants for risk, the goals of involved parties; the scope and complexity of the con-

templated change; the nature of the innovation; the time and resources available; the nature of the target system; and "competing" demands on the system.

To facilitate diffusion efforts, information about available innovations should relate them to the professional development of potential users.

Diffusion is hindered where it must rely on already full or overfull information channels.

INTRODUCTION

The past three decades in the social sciences have witnessed a dramatic rise in concern with social change. This is particularly true for that aspect of social change concerned with the adoption and diffusion of innovations. When an innovation is adopted and diffused within some social system and results in an alteration in the structure or functioning of that system, social change is said to have occurred. The term "innovation" is used here to refer to any idea, practice, or object which is perceived as new to a person or group who might potentially adopt it. By "adopt" is meant the decision to use the innovation on something more than a trial basis. The term "diffusion" refers to the spread of adoption decisions.

The phenomenon of innovation diffusion has been extensively researched in a very wide variety of contexts and covering a broad array of innovations. The orientations or perspectives of the persons involved in conducting these studies has also varied greatly. As one might guess, along with the great diversity characterizing nearly all aspects of diffusion research, there comes a degree of contradiction or "poorness of fit" when comparing particular results or observations provided by different studies. Most importantly,

however, there has also been a considerable degree of agreement among diverse studies on one or another basic issues. There are exceptions to nearly all these areas of agreement, but the issues of agreement represent a convergent validity: the same phenomenon being observed in different contexts and in different ways. Convergent validity is an important criterion in science. When present, it provides confidence to the extension of an observation to a new setting. The larger the number of different contexts a phenomenon can be found in (the greater the degree of convergent validity), the more confident we are that it will be observed in or applicable to a new context.

The observations to be made in this paper all have a high degree of convergent validity. Thus, they are likely to be applicable to the field of education. Some of them already have direct support in this field and their importance is further underscored by convergent validation elsewhere.

Managing Diffusion

Perhaps the very first issue to be addressed is: To what extent can the diffusion process be managed? Are there too many important uncontrollable forces present which may easily disrupt management efforts? Are those factors which are subject to control too costly individually or collectively? Do we, in fact, know what to do once critical factors or variables are brought within our control? The available evidence suggests two important principles.

Principle 1: a planned diffusion process is significantly more likely to succeed than an unplanned diffusion process. Prior explicit planning is very important. The incidence of widespread innovation diffusion is much greater in cases where prior explicit planning diffusion is evident than in cases where it appears lacking. Additionally, the diffusion rate tends to be faster among planned as opposed to unplanned cases of successful diffusion.

A second related principle concerns the quality of planning. Principle 2: the more explicit and detailed the planning process is, the more complete or total the diffusion of an innovation will be. The diffusion process will also be more rapid than would otherwise be the case. The explicitness and detail of planning is a major distinguishing factor between successful and unsuccessful planned diffusion efforts. Successful efforts are characterized by careful needs assessment, meaningful objectives, detailed alternative strategies, contingency plans, and evaluation/control mechanisms. The implication for RDx is clear. RDx should pay very careful attention to need assessment, goal setting, planning and contingency planning. This must be done explicitly and in operational ways.

Principles 1 and 2 seem so very obvious that the reader might question why they are mentioned at all. Surely everyone knows planning makes a difference. Yet what we know and what we do are not always in correspondence. For most innovations, diffusion appears to occur in the absence of any planning, or in the presence of only vague planning. This applies even to those instances where parties have a clear vested interest in achieving rapid and complete diffusion. Careful planning is not a common characteristic of diffusion processes. Even less common is the provision of needed support for implementing diffusion plans. While developers may be concerned with innovation diffusion, they do not often allocate the resources necessary for successful diffusion management. The result is that diffusion is less complete or less successful than would occur with an explicit and detailed planning process.

The evidence supporting Principles 1 and 2 suggest that uncontrollable factors are often not so disruptive as to render diffusion management activities ineffective. Moreover, many important controllable factors do not require unreasonable resources for effective control. Thus, an otherwise disruptive

innovation might be ameliorated by the planners accommodating to it early. A necessary retrenchment can be facilitated if planners anticipate negative outcomes and develop contingency plans. Unrealistic expectations can be avoided by a careful plan.[1]

Joint Considerations of Internal and External Factors

Most diffusion research focuses only on the unit of adoption, such as the teacher or a school. Furthermore, many observers have suggested that change must be imposed upon the individuals or organizations. This is basically a reactive perspective: social systems change primarily in response to outside stimuli. Other studies take a contrary approach, maintaining that enduring change must essentially come from within the social system: The tendency for people to fall into one camp or another obscures an important point summarized by Principle 3: innovations diffuse in response to the interaction of a unit of adoption with its environment. This means that the design of a diffusion system should consider not only adoption characteristics and not only environmental characteristics, but the characteristics of the interaction between adopters and their environment. The focal point becomes the "social" relationship between a social system and its environment. How do schools interact with state education agencies? This question is quite different from the more frequently encountered questions, what can a state education agency do for (to?) local schools, and, alternatively, how can local schools use state education agencies? The RDx needs to continue to study how LEAs make decisions and operate within their environments.

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[1] Some recent attempts to codify some of the knowledge about diffusion management in education and in the broader field of social change can be found in Zaltman, Florio, and Sikorski, 1977; Zaltman and Duncan, 1977; Rothman, et al., 1974; and Rothman, et al., 1976).

Given the importance of interaction and relational analysis, we must ask about discrepancies, i.e., differences in readiness for innovation. A school system cannot move very far ahead of, say, a state agency (an environmental component), nor can the agency move very far ahead of the school systems it may try to assist. The relationship between a school district and a state agency or a regional lab or center will be disrupted or impaired if the district is ready to use a third generation technological innovation, e.g., a highly sophisticated teaching machine, while the state agency may only be able to assist with the first generation version, e.g., a simple teaching machine. Conversely, a state agency will be unsuccessful in diffusing third generation innovations if a school district only has the desire or capacity for the first generation version.

Discrepancies may exist between a school system and a non-educational agency in the environment. These, too, must be considered. A school system in a community must compete with other service interests in the community, such as welfare, public works, fire and police protection, and so forth. A discrepancy exists when, for example, an improvement in the educational system is clearly at the expense of public works. The greater this discrepancy or conflict, the more difficult it is for the school system to advocate the adoption of innovations whose success may be uncertain and intangible. The uncertainty and intangibility dimensions make the school system vulnerable to attack or criticism. This vulnerability lessens innovativeness. This leads to Principle 4: the greater the discrepancy between a school system and an important element of the environment such as a major unit of city government, the less innovative the social system will be. This principle suggests that RDx should consider (a) discrepancies in values, capacities,

and readiness to change which may exist between schools and their environment, and (b) discrepancy-reducing strategies.

The presence of discrepancy-reducing strategies is important. However, discrepancies may not be easily overcome and may need to be confronted directly. This implies the need for political process and conflict-resolution. Only one diffusion model (Stiles and Robinson, 1973) appears to have allowed for a consensus-seeking approach. According to this model, a good diffusion system should be designed to allow for political process as a diffusion strategy. This strategy might entail several steps.

Step 1. Development: marshaling of forces having unmet needs and articulating complaints and proposals.

Step 2. Diffusion: dissemination of the complaints and remedial proposals through public protest and criticism.

Step 3. Legitimation: recognition of the need for change among policy makers and resource allocators at the local level, or, depending upon resistance at the local level, recognition of the need for change among legislators or courts.

Step 4. Adoption: acceptance by professional educators of their responsibility for carrying out the change.

Step 5. Adaptation: actual implementation of change with or without modification.

Zaltman, et al. (1977) suggest:

> "A major implication of the political process model for the change planner is the importance of connecting a desired change with an unmet need of one or more vocal interest groups or stimulating the growth of an interest group centering on the desired change. Creative use of interest groups can greatly speed up the development, diffusion, and legitimation phases. The educational change planner can play an

important role in these phases as a disseminator of information. This suggests another implication of the political process model. Each phase may require different kinds of information, and the change planner as disseminator should be aware of such requirements. For example, in the development phase, information about the nature and severity of a problem should be stressed; while at the diffusion stage, information about particular solutions or remedial proposals should be emphasized.

Organizational Roles in Diffusion

Diffusion research focusing on organization change has many implications which do not appear to have entered into innovation diffusion strategies in education. Such strategies often ignore the internal dynamics of organizations. For example, the differences in perceived and felt needs of persons occupying different social roles within a school system are often ignored. The feedforward concept focuses on the ultimate user; however, the internal environment of a school or district involves many others in the change process. Other roles in change are very important, and the needs of persons in these roles must be assessed as well.

What are these other roles? Briefly, in addition to users, they include:

1. Gatekeepers: People who control enough of a channel of communication to be an arbiter of what information flows into a school system or what information, e.g., product needs, flows from people within the school system to outsiders such as SEAs or regional R&D labs and centers.
2. Opinion leaders: People who offer solicited and/or unsolicited advice (this distinction is an important one) about an educational innovation or innovation needs.
3. Innovators: People who are early users of innovations (and whose felt and expressed needs may not be representative of those of other persons).

4. Decision makers: Persons who have the authority to commit the school system to the adoption of an innovation (and whose felt and expressed needs may not be representative of those of other persons).

5. Implementors: People responsible for putting a decision into effect. (These people may also be users.) The way a decision is implemented may be influenced by the perceptions implementors have of the needs of users.

6. Affectees: People who are not necessarily users but are affected by the use of an innovation. Students may be affected by teacher training programs or organizational development efforts among professional staff in the school system.

People in all of these roles may have strong impact on diffusion efforts. Yet because of the particular concerns of their roles, they have different innovation needs, different information needs, and different needs for assistance and support. It is important to know these differences since persons in different roles act upon their needs, and their actions affect the school system's response to innovations. Also, it is important to know whether or to what extent a need assessment effort is tapping the needs of people in these roles more than user needs. (Of course, a user may also occupy one or more of these other roles.) Thus, Principle 5 states: it is important to identify and distinguish among the needs of persons in many different social roles within a school system. Assessing and ultimately responding only to user needs ignores other vital need sets in a school system. Perhaps the RDx requires a system for classifying school needs in terms of the type

of role(s) most likely to be concerned with the satisfaction of those needs. This may result in better targeting of information.

Just as different change roles imply different needs, so also do different stages in role acquisition. This is true both for change roles and for other more specific organizational roles, e.g., school principal, teacher, student. That is, a person's needs stem in part from role familiarity and experience. For example, a person new to a decision-maker role, such as a new school principal, may be more receptive to innovations which help establish his or her stamp on the system; someone who has internalized that role more completely may be more concerned with innovations that insure a smoother functioning of school operations. Principle 6 states: RDx diffusion strategies must consider where the various role holders are in their acquisition of their roles and what implications this has for structuring innovations, information, and assistance.

Stages in role acquisition include an anticipatory stage, a formal stage, and finally, a personal stage. Individuals begin by depending on formal rules for behavior and replace this over time with reliance on their own abilities and skills. In addition, they move from more mundane, "survival" issues to loftier concerns more in line with self- or system-actualization. The RDx must be prepared to address changing needs implied by the dynamic role-acquisition process. At an early stage in role acquisition, the role holder needs dependable guidelines for successful role behavior. He or she may lack personal assurance as well as proven credibility in the organization. At this time, the role holder will be most open to innovations relating to successful role performance and/or holding some promise of enhancing the role holder's credibility and demonstrating his or her special effectiveness in that role.

Thus, new school principals or superintendents will be anxious to set themselves apart from previous role holders by trying projects that change the system from what it was under previous role holders. New teachers want to do the same with their classes or in the school. However, they will generally look for projects that fit safely within the formal limits on the role holder's discretion.

At later acquisition stages, the role holder has passed the test of survival. He or she is more comfortable with performing the role and more confident of system support. At later stages, the role holder is concerned with maintaining equilibrium and a smooth, effective operation; however, he or she is also likely to become interested in accomplishing something more significant than successful role performance. Obviously, these interests can conflict. For example, the experienced teacher who wants both an effective daily operation and the possibility of significant impact on students faces disruption of the first to achieve the second. Such a person is interested in innovation, but that interest includes a desire for disciplined, systematic change.

It is important to consider not only how different existing roles will respond to innovation, but also to consider that the innovation itself requires the creation of new roles in the system. This suggests Principle 7: innovation diffusion may depend upon individuals within adopting organizations taking on new roles. Thus, as a system adopts an innovation, individuals in the system go through stages of acquiring the roles needed to implement the change. Here we are referring not to change roles in the organization, but to roles in change. For example, adoption of individualized instruction may require that teachers become classroom managers as well as instructors; adoption of team teaching requires that some teachers and administrators become leaders of

problem-solving groups. A task for the RDx to undertake early in the change process is to have teachers or others with information to assist them in the performance of their new roles. For example, initially a school system adopting team teaching may have members who need to acquire group problem-solving skills. It is insufficient for a system such as RDx to provide innovations. The RDx must also be a provider of social skills necessary for the implementation or utilization of innovations.

Support for Change

The preceding paragraphs describing role acquisition suggest Principle 8: diffusion is improved when there exist mechanisms for training participants to take on new roles. This kind of support appears useful for diffusing any complex innovation.

Usually, training mechanisms address needs occurring early in role acquisition, while neglecting those which occur at later stages. That is, assistance in acquiring formal skills is provided, but support for continued growth is not. Such circumstances can foster rapid, but only superficial, diffusion.

Competence for sustained change is not enough; participants must be self-motivated and committed to change. One implication is that those involved in a change should have input into decisions which affect them -- in particular, the decision to try the change and any decision to adopt/continue it. Such participation in decision making is necessary to enhance commitment to change, which in turn is necessary for sustained, motivated implementation. However, participation slows down the change process. Thus, Principle 9 states: diffusion is faster among systems with centralized decision authority, but it is perhaps more effective and complete among systems with participative decision-making structures.

An implication for RDx is that it should encourage the use of organizational development techniques to achieve flexible decision authority patterns; patterns which allow for certain (adoption) decisions to be made through a decentralized pattern, and other (implementation) decisions to be made using a more centralized and thus faster pattern. A further implication is that change participants can be involved in deciding which matters will be in their sphere of interest and which they will surrender in the interests of streamlining the change process. If the participants themselves delegate decisions to a centralized authority, they retain through this delegation decision their "ownership" and control. If adopting systems can be supported in this process, they may resolve the conflict between speeding change through centralized decision making and mediating involvement with change through decentralized decision making.

Innovation Attributes

Much diffusion research has noted the importance of innovation attributes to successful diffusion. Diffusion is faster for innovations that are communicable, simple and nonradical, and have a clear relative advantage; it is more likely to be complete and sustained with innovations that are compatible, pervasive, and have demonstratable impact.

It is significant that all but the last two of these attributes are relativistic concepts; their operationalization requires reference to the state of the adopting system. This points to a probable reason that innovations are frequently underused; that is, they are developed separately from the potential user without explicit reference to user needs, decision processes, and circumstances. Principle 10 states: diffusion concerns begin at the earliest stages of innovation development, where decisions on product form

determine its ultimate communicability, complexity/radicalness, perceived advantage, and compatibility. The goal is to develop forms that are maximally communicable, simple, non-radical, advantageous, and compatible. This can only be done through close and meaningful interactions with potential users, and such interaction is likely to show that, contrary to popular belief, these attributes do not have to conflict with innovation effectiveness. It should be possible to serve ultimate users better by attending not only to features that increase an innovation's potential impact, but also to features that make them easier and less punishing to use.

This implication regarding development can be supplemented with an implication regarding diffusion of already-developed innovations: those responsible for allocating resources to diffuse existing innovations should have a reliable mechanism for screening out those which may not be usable. In educational contexts, screening usually focuses on potential impact; however, products should be screened for "marketability" as well. While a potentially useful innovation should not be dropped just because it is difficult to use, it is only reasonable to decide that it must be dropped or revised if it appears that this difficulty is likely to prevent its use.

Even in commercial settings, product pruning is not easy, but it is routinely carried out for products which threaten the firm's profitability. In nonprofit areas, pruning decisions are even more difficult. There is not as clear a criterion as "profit" and arguments for and against pruning are likely to appear equally cogent. Still, in other social contexts it is necessary to prune innovations that are not needed or wanted to an extent which justifies the effort to diffuse them. Otherwise, we may be simply throwing good money after bad, the effect of which is not only to waste resources on an innovation

that can't be diffused, but also to divert effort from developing or diffusing other versions. This leads to Principle 11: innovations should be routinely and periodically reviewed and the resources spent to diffuse them justified according to impact and marketability criteria. Thus, the RDx needs to provide a gatekeeper function focusing on quality control which would result in a better use of resources and prevent the overloading of SEAs and LEAs with impractical innovations.

Quality control gatekeeping should be carried out continuously. This notion suggests the importance of an innovation's life cycle. Principle 12: diffusion of a particular innovation is likely to be easiest shortly after its introduction, then progressively more difficult as substitutes or competing innovations enter the field and/or diffusion approaches saturation. It is important to realize that an innovation at time 1 may be more readily and cost-effectively diffused than at time 2. It follows that any rationale for allocating scarce resources to diffusing it will lose some cogency as diffusion becomes less cost-effective.

For social products, this point is frequently overlooked. A socially important and effective innovation might receive scarce resources long after the effort to diffuse it is cost-effective. "Mature" innovations are costly to diffuse for several reasons. As mentioned, competing innovations enter the arena and preempt part of the target audience. Additionally, as the innovation is more and more completely diffused, the remaining efforts must be aimed at late adopters and "laggards," traditionally the most difficult group to reach. Thus, it is important for the RDx to determine where an innovation is in its life cycle and to prune or reduce allocations for "mature" innovations in favor of younger ones.

Perhaps the single most important attribute an innovation should have is flexibility or adaptability. Diffusion is hindered when the innovation does not fit easily with the variety of conditions characterizing adopting systems. Further, the commitment and competence needed within adopting systems may require that individuals have input into the ultimate form the innovation takes. Thus, innovations should be malleable in ways that allow adopters to determine their nature and use. Susceptibility to modification seems to be an important innovation attribute. Social innovations should be designed so that significant user adaptation is possible at the time of use. This raises a very difficult issue. User adaptation of an innovation may inadvertantly lessen its effectiveness on quality. Conceivably a particular alteration could be very dysfunctional. There is no evident feasible way for the RDx to maintain quality control once provision for substantial alteration is built into the innovation.

A final point about innovation attributes concerns which of these should be stressed in communications to users. Innovation attributes provide the basis for descriptive "promotional" communication to and among potential users. Depending on the stage users are at in their acquisition of innovation-related roles, information should stress user rewards (at early stages), then potential impact (at later stages). Since the diffusion strategist is likely to want to provide as much information as is feasible, the point is not that he should provide one or the other type of information, but rather, that he should gear his information to the attributes that relate to incentives or reasons for use. In social change areas, incentives for innovation involve the career paths of professionals charged with adoption and implementation. Financial incentives are important, but professionals are ultimately most concerned with enhanced prestige, status, and position. Thus, developers

and diffusion strategists need to consider aspects of the innovation that could be positively or negatively related to the career development of individuals who will participate in the change.

Organizational Communication

Diffusion is most easily accomplished among social systems with open and viable communication flows.

The importance of internal flows to organizational innovativeness is suggested by our earlier discussion of decision-authority patterns. Open vertical and horizontal flows may slow the process of innovation, but may also be essential for sustained change.

Open inter-system flows do not have the same effect; rather, the more extensive and open these communication networks, the more rapidly diffusion will occur. However, effects on the individual systems involved may be uneven. Those systems which are proactive, seeking to assert and maintain control over the environment rather than the other way around, will adapt the innovation and incorporate it more slowly; those reacting to environment pressures will co-opt or preempt the innovation, adopting it relatively rapidly, but not experiencing sustained change. All organizations are more likely to adopt innovations when they have viable external linkages, but the process is more disruptive and often frustrating and superficial in those systems which respond to the environment rather than interact with it.

It is commonly believed that communication problems are problems of blocked flows or restricted information; however, problems of overloaded channels are equally important (Rogers and Rogers, 1976). Diffusion is hindered where information channels are overloaded. Delay and distortion are characteristic of communication which depends for transmission on such channels.

Overload may be due to too much information or information in forms that are not efficient or effective. Thus, one task for the RDx is to screen and process information so it is maximally efficient; another is to study the existing channels and determine whether there is too much competing information for effective use of the channel. If so, strategies for improving existing channels or developing new ones must be devised. It has been speculated that we may someday have to devise ways to restrict and qualify information flows, much as we have begun in this country to restrict our food intake. "Ours is said to be the first society in which overeating is a problem for most of the people. A recommended remedy is self-discipline on intake and a balancing [physical] regimen. Perhaps in analogous fashion ....a new ethic is required that defines knowledge for its own sake as waste, and... unrationed intake....as gluttony." (Wiebe, 1971)

It is important to note that attempts to reduce overload may lead to important distortions and omissions. For example, a gatekeeper relaying information may allow his own biases to determine who learns about what innovations. If this happens, diffusion can be thwarted by seemingly useful attempts to streamline information flows.

Other Organizational Considerations

There are several implications for innovation diffusion in education to be derived from organizational change theories. Perhaps the most important distinction to be made initially is that innovation adoption by organizations consists of three important phases expressed in the next principle. Principle 13: the RDx should distinguish among the following stages: initiation, implementation, and resolution. During the initiation stage, the organization becomes aware of an innovation, becomes knowledgeable about it, makes

evaluations, and then decides either to try or to reject the innovation. During the implementation phase, the organization changes its practices to accommodate the innovation and perhaps alters the innovation. During the resolution phase, a decision is made to continue or to discontinue usage of the innovation on a more or less permanent basis. This phase involves an assessment of the impact of the innovation and efforts to reduce conflict generated by the innovation. Modification of the innovation may also occur during this phase.

Different types of change agent activities are required at the different phases. For example, the provision of information about the innovation and its success in other educational settings is important during the initiation phase, while conflict reduction activities and innovation adaptation activities are particularly important during the latter two stages. Assistance in evaluation research and its interpretation may also be necessary during the resolution phase.

The RDx should also be sensitive to the impact of various organizational structure considerations. For example, initiation is easier when authority to innovate is decentralized, when the organization has relatively few rules affecting activities necessary during the initiation phase, and when there are many channels of information readily available to the school.

As implied above, it is very important for change agents to work closely with potential adopters. In doing so, Principle 14 should be considered: the RDx should be sensitive to the informal as well as formal aspects of the organizations identified as potential adopters. Diffusion of innovations is much more rapid when informal aspects of organizations are considered explicitly. Informal social systems within schools may be as important in the

adoption process as the formal social system as reflected by an organizational chart. Thus, we might distinguish between adoption by informal groups and by formal groups within a given school building or a given school district. Overlap may exist between the two groups, of course.

Selection of Diffusion Strategies and Tactics

One basic issue in diffusion management is who the best initial target should be. Several principles can be derived from the extant literature on this topic. The principles will be cited in terms of considerations a change agency should attend to in developing a change strategy. Principle 15 is that an explicit decision should be made whether to approach the most likely or the least likely schools to adopt an innovation. This issue is often referred to as the strategy of least resistance versus the strategy of greatest resistance. When pressure is great for demonstrating an early success, agencies should focus their initial efforts on those schools most likely to adopt an innovation. This is also desirable when word-of-mouth communication and legitimation processes are important. On the other hand, the most likely schools to adopt an innovation may do so even without nurturance by external agencies. Thus, it may be wiser to concentrate resources on those school systems which are most resistant to change since innovative schools may adopt anyway.

Diffusion research also suggests Principle 16: the RDx should select schools on the basis of the degree of felt or perceived need for change. If a school does not feel a strong need for change, they may adopt an innovation, if at all, on the basis of political pressure, but not implement the innovation. This may be very dysfunctional to the RDx since the adopting school is likely to have little "showcase" value.

Related to felt need is the degree of commitment a school may have toward the act of changing. Principle 17 is that a change agency should determine that a strong degree of commitment to change exists in both the formal and informal systems of schools before proceeding with a major diffusion effort. Having a strongly felt need does not automatically imply that a school will be committed to change. This is particularly likely if the belief exists that the need is essentially "unmeetable" or if there is suspicion of the change agency.

Principle 18 states that change should not be undertaken if the school system does not possess the necessary financial and human resources to (a) accept change, and (b) sustain change. An exception to this, of course, is when the change agency or another organization is able and willing to provide these resources. Thus, the existence of felt needs and a readiness to accept change alone are not sufficient reasons to proceed with a major diffusion effort.

Principle 19 is that a change agency should consider the possibility of a heterogeneous audience of potential adopters who might be classified in ways which require different diffusion strategies and tactics. For example, school systems vary along many dimensions such as per pupil expenditure, size, community socio-economic characteristics, and so forth. Diffusion research suggests that the dimensions relevant to the innovation at hand be identified and school systems clustered in terms of where they fall along these dimensions. Each such cluster may require a different approach and may have somewhat different needs. Diffusion efforts which segment target audiences appear to have substantially more success than those which do not.

Change agencies commonly assume that potential users of an innovation are all in the same decision-making stage. Principle 20 is that the RDx

should assume that potential adopters will vary in terms of where they are in a decision process. Some schools may not be aware of an innovation, while others are only aware of it, and still other schools actively assessing the value of the innovation. Different approaches are necessary for schools in different decision-making stages.

Diffusion planners conveying information have available a large array of tactics for mediating commitment and learning and facilitating implementation. A major category subsumes information tactics such as use of direct mail, use of the mass media, use of salespeople or field agents, and workshops or informative product packaging. Other categories of tactics are product development, user involvement, legal, and training/assistance tactics. The planner's skill in combining and using such tactics determines their effectiveness for promoting innovation-diffusion.

Diffusion/change tactics can be characterized on a number of dimensions which relate to their usefulness for different change goals, target systems, and change contexts. One such dimension, stability, is characteristic of tactics which generally operate as intended with little change of deviation or unexpected consequences. Examples might include the tactics of mandating simple changes, using direct mail messages, or subsidizing change. Tactics with less predictability might include personal selling, consultation, or confrontation tactics.

In general, use of high-stability tactics defuses risk and increases the planner's confidence in the likelihood of the outcome. Such tactics are also useful for achieving a consistent effort with a divided target population and/or over time. However, stability may be obtained at the cost of real impact -- as, for example, when direct mail is used instead of a telephone call to solicit cooperation.

Tactics which involve personal contact are good for obtaining commitments and influencing the change process. This is Principle 21. However, they may be expensive and unstable. Similarly, a greater amount of interaction between the change planner and the change implementor is desirable, but usually costly and unstable.

Tactics which do not compel user involvement are less assured of long-term impact. Thus, legal tactics mandating change work only as long as vigilence over implementors is maintained.

In a related vein, Principle 22 suggests that tactics which involve extra "work" on the part of the receivers tend to mediate better learning and more commitment. Thus, information tactics such as direct mail may be less powerful than training tactics. Learning from a technical journal article is likely to require more participation than would learning from more simple material such as advertising. Redundancy or irrelevant content associated with a tactic increases the need for a user to participate and work to get the message. However, tactics requiring greater effort may discourage involvement initially, so they must be used with care.

Principle 23 suggests: when a diffusion/change planner has only limited resources, he must attend to dimensions of tactics such as cost, potential coverage, and repeatability. Further, the diffusion planner must consider the user/implementor's resources as well.

School people have limited time as well as money. The planner must consider whether the demands on their time required by the tactic are reasonable. Thus, while confrontation or encounter group experiences may be potent for achieving change in schools, it may be that school people do not have the luxury of time required to participate in such experiences.

The change planner must also consider whether the tactic chosen is appropriate to the change state being facilitated. This is Principle 24/ At late stages, potential adopters/users must have some opportunity for hands-on experience with the innovation in question. At such stages, tactics such as action research (to derive and demonstrate the need for change) or invoking authority are too abstract in their depiction of the innovation; demonstrations or contact with field agents may be far superior.

Choice of tactics to use should reflect careful consideration of the decision stage to be reached; the tolerance of participants for risk (i.e., the cost of failure); the planner's and implementor's goals; the scope and complexity of the contemplated change; the nature of the innovation; the time and resources available; the nature of the target system (relevant actors, decision/authority structure, resources, values, characteristics, and incentive structure); and the nature of "competing" demands or appeals.

Distribution Systems

Diffusion depends on information flows; it also depends on distribution systems for innovations to travel from developers to users. Commercial distribution systems arise and are modified to maximize efficiency and profitability. Principles of "minimum total transactions" and "assortment-of-goods" (illustrated by Figure 1) guide the creation of distribution structures. Thus, systems are devised which reduce the total number of transactions required between producers and ultimate consumers, and reconcile the narrow product offering from each source of supply into a wider assortment at the point of sale.

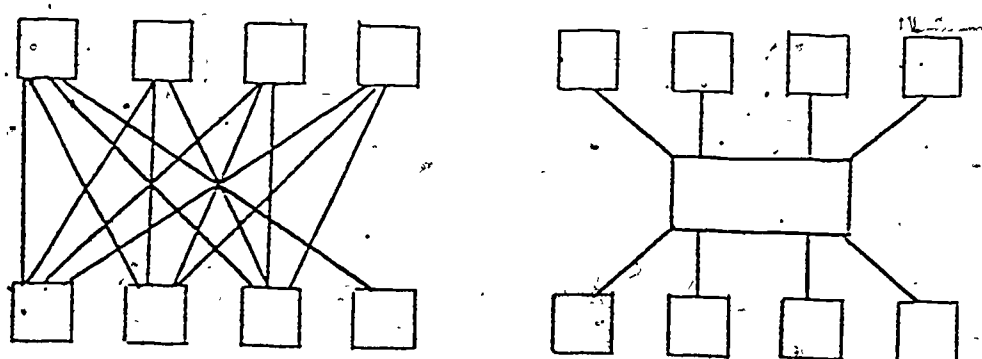

Figure 1

Source: Kollat, et al, p. 286

Distribution is an important variable to consider for enhancing profits by reducing costs. Further, it is often the source of major breakthroughs by commercial marketers. Many companies have attained great success not through product innovation, but instead, through an effective, innovative distribution arrangement. A&P's cash-and-carry stores; the dealer structure of G-M; the discount store; shopping centers and supermarkets -- these are cited as examples of distribution ideas which spelled major success for their initiators. Thus, in commercial settings, there is great interest in distribution as a variable important to diffusion of products.

In social change programs, there is a corresponding concern with distribution structures. The study of linkages is a major intellectual endeavor. However, there remain to be developed effective systems for distribution of social products. This is due in part to the kind of attention given this variable. Funding is usually for research rather than development of linkage arrangements; it goes to projects which are separate from developers of social

innovations and is usually not applied research in the sense of being intended to obtain real efficiencies with particular products. Finally, concern with linkages focuses on information flows rather than product flows. A recent report prepared for the RDx (FWL, February, 1977) outlines some of the distribution inefficiencies that characterize educational diffusion efforts. The problem seems to be not a lack of interest, but rather the unique challenge of distributing complex educational innovations. The wide variety and complexity of products, the complexity of consumer decision structures, and the social importance and volatility of this area all pose major problems for distribution.

Multiplier Effects

An important concern in developing strategies for diffusing educational innovations is the identification of potential adopters who themselves may act as agents of change. This creates a multiplier effect, whereby one teacher or school adopting an innovation becomes responsible for its adoption by several other teachers or schools. The task facing the RDx is how to identify the best potential adopters of an innovation. Some prescriptive guidelines for addressing -- but not solving -- this task are presented here.

The best potential adopter is one which has a (1) high early adoption propensity; (2) high volume propensity; (3) high influence propensity; and (4) low cost of effective exposure. In the following section, we shall clarify each of these concepts with reference to the teacher as the basic unit of adoption (see Kotler and Zaltman, 1976).

Early adoption propensity is defined as the probability that, say, a teacher would be an early user of the innovation upon an effective communication exposure. Early adoption propensity is a function of the following subfactors:

1. The extent to which the innovation has strong need fulfillment potential for the teacher.
2. The extent to which the teacher has an innovation orientation. This is determined in part by cultural values, and in part by individual personality.
3. The extent to which the innovation is highly accessible to the teacher.
4. The extent to which the teacher has the resources to acquire the innovation.

Each of these factors is important in whether or not a teacher will have a high propensity to adopt a particular innovation. Let us assume that each factor can be scaled from zero to one. It is suggested that these factors would combine in a multiplicative way. For example, the highest early adoption propensity would be found in a teacher who has a strong need for the innovation, tends to search out innovations, can easily acquire it without much effort, and has the requisite resources. The formula is multiplicative because if any factor is weak, the early adoption propensity drops considerably. It is not the case that the propensity would be high simply because two or three factors are very high.

Heavy volume propensity is the amount of the innovation that the teacher is likely to use when it is used. This propensity depends upon the following factors:

1. The probability that this type of teacher will be sufficiently satisfied with the innovation upon trial to use it again.
2. The average amount used by this teacher per use occasion.

These factors probably combine in a multiplicative way to determine the person's heavy volume propensity.

The proportion of persons that the prospect influences depends upon three factors:

1. The teacher's innovation conversational propensity.
2. The percentage of his or her acquaintances who are potential users of this product.
3. The degree to which other persons look upon this person as a legitimator of innovations.

This says that the prospect will show a higher influence propensity the more he or she tends to talk about innovations they have tried, the more he or she talks to others who are interested in the area of the innovation, and the more he or she is seen as a legitimator of new ideas.

Communication cost is the cost of delivering an effective message with a given media vehicle to a given prospect. This cost is defined as some function of the following factors:

1. The probability that he or she will be exposed to the message with the media.
2. The probability that he or she will see the message.
3. The probability that he or she will comprehend the message.
4. The probability that he or she will be favorably impressed by the message.
5. The actual cost of getting the given message exposed to the given individual with the given media.

CONCLUSIONS

Some implications for the RDx from the diffusion principles include:

1. An early investment in explicit and deliberate planning will pay off, being more valuable in the long run than plunging into vaguely planned diffusion efforts with the hope of later retrenchment and improvement. A trial-and-error approach could make "sacrificial lambs" of the innovations and linking institutions which become involved and may be wasteful of scarce resources.

2. Planning should take account not only of the target or beneficiary systems, but of their relation with their environments as well. It is necessary to consider discrepancies in values, capacities, readiness to change, and to develop discrepancy-reducing strategies. This includes political process and conflict resolution strategies.

3. RDx should be more concerned with assisting the growth of proactive, outreaching beneficiary systems than with diffusing specific innovations. The implication is that RDx might focus on SEAs and other linkers' abilities to proactively address practitioner needs, rather than just helping them respond to requests from the field. RDx should help clients (e.g., SEAs) develop strategies to be proactive, not just find products to deal with schools.

4. RDx involvement in specific change efforts should be sustained throughout each effort and deal with training and assistance needed at later change stages as well as early change stages.

5. RDx must be concerned with having the participation of all affected groups in the change process; and RDx should consider this a more important early goal than that of having a smoothly functioning operation (possibly at the expense of wide participation).

6. To effect a balance between efficiency and client-responsiveness, the RDx needs to support flexible decision-authority patterns, patterns which permit a wide representation of users to delegate certain decisions to a centralized authority and retain others for participatory procedures.

7. An important role in the diffusion of the outcomes of educational R&D is that of assessing and/or regulating the quality of available outcomes. As a support system, RDx can play a part in developing mechanisms to screen outcomes for "marketability" and effectiveness. Screening and pruning are important not only as quality control functions, but also to avoid or reduce information channel overload.

8. The array of innovations or resources available should be responsive to user needs. This requires contact with users.

9. Ultimately, it is the quality of RDx feedforward which will determine the quality of RDx dissemination. Responsiveness to the field will depend on the information provided through feedforward.

10. The process of feedforward must use a definition of needs which is role-related. Whose needs and for what?