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STRACT

Research memoranda numbers 10 through 14 are included this 6th volume. (The general nature of the memoranda and related cuments are described in SO 005 892). The Research Memoranda essays e: #10) "On the Meaning of Demand for Knowledge" by Bent Stidsen; 1) "On Knowledge Utilization in Education: Some Strategic plcrations by Lee Thayer; #12) "Mass Culture and Mass Education: A view of Potential Mass Media Uses Under Varying Social, Political, d Cultural Conditions" by Hanno Hardt; #13) "What is knowledge that can Be used? (An Educational Inquiry)" by Marc Belth; and #14) he Implications of Technics in Education" by Elizabeth S. Conley. uthor/SJM)

Final Report

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Toward a Reconceptualization of Knowledge Utilization in Education

Volume 6 of 8 Volumes

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Project: NCEC Knowledge Utilization Study

Research Memorandum #10:

"On the Meaning of 'Demand for Knowledge'"

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INTRODUCTION

This research memorandum contains a discussion of the issue of knowledge utilization in the light of basic marketing principles. With the possible exception of the demand-supply parameters outlined in the memorandum, the marketing analysis presented is one widely used in the marketing of technology.

The U.S. Office of Education has already sought to apply elements of a marketing approach to the problem of knowledge utilization. In recognition of what has already been considered as policy, some action possibilities (e.g., the utilization of advertising agencies) are merely mentioned without further elaboration.

Rather than attempt to sort out what the reader already knows, however, a substantially complete marketing analysis of the problem of knowledge utilization is presented. It seemed both more effective and more efficient to write as if the perspective involved here had not been considered at all rather than attempting to outguess the reader regarding what he already knows. In any case, the aim here is not so much invention as it is an operational integration of some of the ideas presented in preceding research memoranda.

The Issue

It follows quite clearly from Thayer's basic definition of communication (Research Memorandum #1, p. 3) that the rate and quality of knowledge utilization depend upon both the supply and the demand for knowledge. The purpose of this research memorandum is to formulate an operational definition of the terms "supply and demand for knowledge" consistent with the conclusions developed in the preceding research memoranda. By the term "operational definition" is here meant a specific set of knowledge "marketing" operations that a particular knowledge utilization facilitation agency (e.g., ERIC) might perform. That is, the issue here is action, not measurement. The following discussion is, therefore, couched entirely in terms of ways of facilitating rather than in terms of the problem of specifiying and measuring "the" optimum equilibrium of supply and demand.

Point of Departure and Terms of Reference

The point of departure for this research memorandum is the concept of marketing. The aim is to structure the problem of knowledge utilization as one would any other marketing problem. To this end certain basic definitions will be helpful.

First, marketing is the process by which producers and consumers make contact with and influence each other in the interest of the distribution of economic goods and services. Without in any way seeking to imply that marketing has been perfected as a discipline and as a practice there are,

nevertheless, certain well-established principles and practices of marketing which seem applicable to the problem of facilitating knowledge utilization.

Second, an integral element of marketing concepts and practices is the principle of consumer orientation. The logic of a marketing plan begins and ends with the needs and desires of the consumers and users of economic goods and services. In consequence, a sizeable body of theory and research pertaining to the problem of analyzing and measuring consumer needs and preferences has been developed by marketers. Much of this would seem directly relevant to those engaged in the marketing of knowledge.

Third, one of the more significant institutional elements of marketing is the distribution channel. It may be defined as the sequence of agencies (e.g. wholesalers and retailers) and operations associated with the distribution of a particular producer's products. At the very least, the concept of the distribution channel, and the dimensions of tasks and agencies characteristic of various channels, may serve as a practical reference for the development and organization of agencies devoted to the facilitation of knowledge utilization.

Fourth, one of the more crucial "functions" of marketing and of the various distributive agencies is product assortment transformation. At the production stage products are assorted on the basis of common raw materials and common production processes. Through various wholesaling and retailing agencies these homogeneous product assortments are reassorted to

eventually form categories roughly based on user and usage criteria. Thus a grocery retailer carries the products of hundreds if not thousands of manufacturers. By thus assorting individual product categories into usage categories wholesalers and retailers facilitate consumer comparisons and consumer choices among the myriad of competing and complementary products available.

Fifth, in addition to physical distribution, marketing involves demand creation and realization. Through promotional agencies and activities producers and distributive agencies seek to focus consumer needs and wants on particular products. A large and increasing body of theory and research has developed around the problems of planning and implementing effective and efficient promotional campaigns. Even if many aspects of promotion (and particularly of the proper functions of promotion) still are open to question, many of the promotional methods and experiences of marketers, nevertheless, seem relevant in any discussion of the issue of knowledge utilization facilitation.

The basic marketing concepts broadly defined above are presumably not entirely unknown to knowledge disseminators. Publishers, television producers, movie producers, and magazine editors are just a few examples of knowledge disseminators who, in general, seem thoroughly familiar with marketing principles. Yet, many investigators have suggested that the supply exceeds the demand for knowledge. Or, to put it differently, some investigators, in their statements of the "problem" of knowledge utilization, imply that not all of the "available" knowledge

is being "used."

Of course, the issue or "problem" of knowledge utilization is rarely, if ever, stated in terms of supply and demand. Rather, it seems usually to be stated as a differential between the "knowledge" possessed by two groups of individuals (e.g., scientists and practitioners). But, as pointed out in earlier research memoranda, stated as a problem of differential possession of knowledge, the "problem" of knowledge utilization implies that homogeneity of knowledge within an epistemic community is an ideal to be sought.

While homogeneity of knowledge possessed seems an attractive ideal in some epistemic communities, one may presume heterogeneity to be a more suitable ideal in education. In that case, what does it mean to say that "supply exceeds demand for knowledge"? How could one know if this were so? And, if one knew it to be so, what could be done about it?

Marketing and marketing principles appear to provide a basis for answering questions such as the above without the aid of the assumption that the ideal is homogeneous possession of knowledge. But first it will be helpful to define specifically two concepts: (1) the concept of demand; and (2) the concept of a unit of knowledge.

The Concept of Demand

The economic concept of demand denotes those biological, psychological, sociological, and cultural characteristics of the individual human which manifest themselves in his needs, wants, and desires for economic goods and services. These needs, wants, and desires can be definitively described in

terms of two parameters: form and intensity.

The form of demand is defined in terms of products or goods. Note that "demand" has no effective meaning except in the specific sense of the particular product which is demanded. In this sense demand is a derived concept which depends for its specification upon supply.

The concept of demand intensity has presented a major problem for economic theorists. It seems intuitively clear, for example, that a hungry man's demand for toothpaste is less intense than is his demand for bread. But, once stated, this same man's demand priorities may well have changed relative to each other. For example, his demand for toothpaste may then be more intense than his demand for bread. Demand intensity may thus vary across different individuals as well as over time for the same individual.

It is unnecessary here to recapitulate the details of the debates among economic theorists concerning the measurement of demand intensity. Suffice it to assert that both the form and the intensity of demand is specifiable under the following conditions:

1. There exists a specific and finite set of economic products with constant relative "prices" from which
2. a particular individual with given personal tastes,
3. and a given money income and inventory of possessions,
4. selects a specified product or good,
5. in the interest of maximizing his personal satisfactions.

Under these conditions the specified individual's demand schedule can be developed for the particular product at varying "prices." This demand schedule represents the individual's effective demand. The term effective demand is used to differentiate that which an individual is both willing to buy and capable of buying, from that which an individual is merely willing but unable to buy because of insufficient money income.

The conditions under which effective demand is specifiable may be generalized to the case of demand for knowledge by appropriate changes in terminology. Effective demand for knowledge may be definitively specified under the following conditions:

1. There exists a field of knowledge from which
2. a given individual with given attitudes and values,
3. and given willingness and ability to expend effort on acquiring knowledge,
4. selects a specified unit of knowledge
5. in the interest of maximizing his personal competencies or interests.

These are clearly very stringent conditions which are difficult to satisfy in the "real world." There are, however, a number of marketing methods which will enable an approximate satisfaction of these conditions.

Note that under the conditions stated above there can be no effective demand for knowledge in general. Demand

for knowledge must, therefore, be stated in terms of some unit of knowledge. The specification of such a unit is the next issue.

The Concept of a Unit of Knowledge

Unlike technology, knowledge does not afford an immediate and obvious unit of demand. From a supply standpoint a number of units of knowledge have emerged in particular contexts (e.g., class hour, lecture, course, book, article, theory, experiment, and the like). But these are not entirely convenient units of demand. They are often not demanded as a whole and they are usually structured to suit the supplier rather than the consumer. In fact, most existing units of knowledge are derived from the needs of suppliers to have some way of measuring their "contributions" to particular fields of knowledge. These units are, therefore, inconsistent with a marketing perspective of knowledge utilization. A unit of knowledge related to consumer needs and requirements is required (cf. Research Memorandum #5, pp. 7-8).

Some traditional concepts of knowledge stand in the way of the formulation of such a consumer oriented unit of knowledge. If one thinks of knowledge as a "body," "field," or "state" existing independently of its producers and users then it is not at all clear what a consistent unit of knowledge might be. Also, if one views knowledge as "deep insight and understanding" (i.e., as a state of its possessor), then the task of formulating a demand unit seems all but hopeless (cf. Research Memorandum #5, p. 4).

There is, no doubt, a demand for "deep insight" underlying peoples' knowledge acquisition activities. But as in the case of the concept of "consumer satisfaction" in economics, "insight" cannot be effectively demanded. Indeed, it would seem that no particular outcome of any process can be effectively demanded. A consumer may want white teeth or a sense of security in "close-up situations" but he cannot buy that. To rank as an effective demand this want must be expressed in terms of the means to the accomplishment of the desired outcome.

Now, regardless of a particular individual's state of knowledge and regardless of how he conceptualizes this state, his means to the accomplishment of modifications in that state (e.g., expanding, revising, or reinforcing his knowledge) is the question. Consequently, the answer is a consumer-oriented unit of knowledge. To rule out the possibility of constructing questions by sheer word manipulation, the basic consumer oriented unit of knowledge will be defined here as any answer to any meaningful question.

There are no time and space limitations implied in this unit of knowledge. A question may be answerable in one word or it may prompt a major research effort requiring years for its completion and many volumes for its statement. Also, this unit of knowledge does not presuppose answers of a particular quality or "rightness." The sole requirement is that a given statement be recognizable as an answer to a given and meaningful question.

To ask questions a consumer must posses some minimum "amount" of knowledge insofar as he must know what he does not know. Since anyone who can ask questions thus possesses knowledge, he is, by definition, also a potential supplier of knowledge (cf. Research Memorandum #6). On this basis the following kinds of demand-supply situations may exist for a particular individual:

1. The individual generates his own questions and his own answers. This situation includes the case of "intuitive" problem solving as well as a good many cases of scientific research. Much extant knowledge comprises the written records of someone's attempts at answering his own questions.
2. The individual generates his own questions and poses them to someone else. This is roughly a situation comparable to the economic concept of effective demand.
3. Someone else generates questions, the specified individual generates answers. This is the mirror image of the preceding situation and defines effective supply.
4. Someone else supplies both questions and answers. This is roughly the case of closed-system training (cf. Spec. Inv. #1, p. 12).

From the standpoint of a knowledge marketer (i.e., an agency devoted to the facilitation of knowledge utilization)

situations (2) and (3) above describe the most obvious and immediate set of opportunities for fruitful intervention. The most significant problems of knowledge utilization inhere, however, in the discontinuities between situation (1) and situations (2) and (3). It is in searching out and transforming what is essentially the private knowledge development of some individuals to make it consumable by others that the knowledge utilization facilitation agency most resembles a marketing agency. Closed-system training (situation (4)) is a special case of knowledge utilization and of marketing. Notwithstanding the fact that many instances of formal education at all levels resemble closed-system training situations, one may perhaps be permitted to assume that it does not constitute an ideal except in certain very specific contexts. In any case supply creates its own demand in closed system training and degree of control is the variable rather than the form and intensity of demand.

The problem immediately facing the knowledge marketer is thus one of developing ways of facilitating interaction in the cases of effective supply of and effective demand for knowledge. Though one might expect that effective suppliers and consumers of knowledge already do interact to a significant extent via existing media, there are still significant benefits to be derived from an agency organized to facilitate such interactions. If organized appropriately such an agency could significantly expand the communication systems of those who already are aware of and deliberately seek to exploit their communication systems.

In addition, and perhaps more important, an agency organized to facilitate people talking to each other about their problems forms a prototype of knowledge utilization facilitation agencies. Other functions and services may be added subsequently. But, basically the knowledge marketer must strive to facilitate interaction between suppliers and consumers of knowledge. It is not, and cannot be, the task of a knowledge marketer to ensure that particular units of knowledge rather than others are being "used". It is the process of interaction between suppliers and consumers that comprises the knowledge marketer's realm of responsibility -- not the outcomes of those interactions.

It is crucial, then, that a knowledge marketer actively discourage a degeneration of the knowledge utilization process to a case of closed-system training. One seemingly effective way of discouraging such a degeneration (e.g., to a point where educational scientists determine both questions and answers for educators) is to organize the agency to depend on consumer questions for its basic knowledge dissemination activities. Auxillary functions may be developed subsequently to encourage those who do not now ask questions of or provide answers for others to avail themselves of the agency's services. But knowledge utilization and not propaganda is the basic business of a knowledge marketer.

Some Performance Criteria for a Knowledge Marketer

It should perhaps be emphasized that a knowledge marketer's function is not to replace instances of private or personal knowledge generation and utilization (situation (1)).

Rather, his function is to facilitate the maximization of the quality of the knowledge generating and utilization activities of the members of the relevant epistemic community. The best questions and the most advantageous answers for any particular individual may well be those he generates himself. Also, one would expect the supply-demand relations in any particular epistemic community continually to reverse themselves in the manner of a conversation or a dialogue.

Clearly, the knowledge marketer cannot himself evaluate the quality of the questions and answers that pass through his agency. He might well be able to provide some crude ranking of various questions and answers with respect to given criteria. But, on the whole, the decision as to what is a good question and what is a good answer must rest with knowledge suppliers and consumers.

But how then can the knowledge marketer "facilitate the maximization of the quality of the knowledge utilization activities in a particular epistemic community"? The quality of a particular question or a particular answer depends upon the universe of questions and answers from which it is selected. In fact, if there exists only one answer to a particular question it is not even clear what "goodness" or "quality" means. There must be at least two alternative answers to any given question (and at least two alternative ways of questioning a situation) before an evaluation of the answer (question) can realistically be made and the "best" answer (question) chosen.

This then is how the knowledge marketer facilitates the maximization of quality in knowledge utilization: by making available, or seeking to encourage the development of several ways of questioning given operational situations and several alternative answers to given [illegible]. There is, no doubt, an upper limit to the number of ways of questioning and answering that can be handled by an individual in any given decision situation. But, it seems doubtful that this upper limit will present an immediate problem (cf. Research Memorandum #6).

In sum, the knowledge marketer is in the business of facilitating interactions among knowledge suppliers and knowledge consumers. It is important to keep in mind that the terms "supplier" and "consumer" denote roles rather than specific individuals. Some "consumers" are their own "suppliers" and vice versa. Also, the educational knowledge marketer would be incorrect in assuming that teachers have only questions (i.e., that they are only "consumers") and that educational scientists have only answers (i.e., that they are only "suppliers"). The function of a knowledge marketer is one of facilitating or furthering the process of interaction among the members of an epistemic community. Whether such interactions lead (in the case of education) to "better" teaching or more effective education is not at issue in knowledge marketing. That is, and should remain, the responsibility of the knowledge suppliers and users served by the knowledge marketer.

Toward a Method of Analyzing Demand for Knowledge

Like the marketer of economic goods and services, the knowledge marketer must to some degree seek to anticipate the demand for knowledge. The structure of his "storage" and his retrieval capacities depend upon such anticipation.

The first and most important element of a "demand analysis" is to establish the basic need structure of the epistemic community involved. More specifically, the knowledge marketer must find some way of pre-structuring his "product" (questions and answers) in relation to the logical and operating structure of the epistemic community involved without precluding interactions which might have the consequence of changing that structure.

The method of demand analysis developed below is based on the following assumptions which roughly delimit situations involving effective demand and supply:

1. There exists a number of individuals in an epistemic community whose worlds are not entirely resolved. Questions occur from time to time, whether in "crisis" situations (direct confrontation of an individual and a situation in which he does not know how to act), or in "creative" situations (an individual inventing an inadequacy in some aspect of his world).
2. There exists an agency devoted to the marketing of knowledge in that epistemic community.

3. The tasks of the individuals in this epistemic community are only partially definable. It is not a case of closed-system training.
4. The individuals involved are active knowledge producers and users.
5. There is a positive orientation to knowledge utilization in the epistemic community involved.

In keeping with the basic conditions for the measurement of demand specified earlier, the elements of demand analysis are:

1. Specification of the boundaries of the epistemic community to be served as well as of the relevant "field" of knowledge.
2. Specification of the knowledge utilization characteristics of the knowledge suppliers and consumers who form the selected epistemic community.
3. Segmentation of knowledge suppliers and consumers with respect to specified knowledge utilization characteristics.

It is not possible here to develop a complete and definitive analysis of the market for knowledge in the educational epistemic community. Such a complete analysis would, in any case, have to await the performance of more specific studies of the supply and consumption behavior in that market than those presently available (cf. Research Memorandum #6). A number of techniques and guidelines for market segmentation and consumer behavior analysis are described in the marketing literature.

In place of a fully definitive analysis, it is, however, possible to formulate a set of generating principles from which to develop the parameters of more specific and empirical analyses. The generating principles for market segmentation and consumer categorizations with respect to primary and secondary education are:

1. Situational Parameters:
   (a) Kind of school (elementary, high, special education, etc.).
   (b) Place in school (classroom, administrative, counselling, etc.).
   (c) Kind of subject taught (mathematics, English, history, etc.).
   (d) Kind of student taught (grade level, I.Q. level, "disadvantaged," etc.).
2. Media Parameters:
   (a) Media vehicles (articles, books, tapes, filmstrips, etc.).
   (b) Method of presentation (speech, print, illustrated, animated, documentary, various embodiments, etc.).
   (c) Form of presentation (descriptive, abstract, conversations, dialectical (participation), news events, etc.).
   (d) Source of presentation (popularity, prestige, credibility, etc.).

3. Usage or Consumption Parameters:

   (a) Situational questions (school design, classroom design, curriculum design, schedules, general rules for behavior, etc.).

   (b) Means and media questions (methods of teaching, teaching equipment, open-closed schools, student participation, etc.).

   (c) Subject matter questions (instructional materials, content-updating, etc.).

   (d) Questions pertaining to teacher-student relations (learning theory, teaching theory, grading and reporting, teacher roles, etc.).

4. User or Consumer Parameters:

   (a) Role (teacher, student, administrator, department head, etc.).

   (b) Level of competence or authority (level of education, ability to change and be changed, etc.).

   (c) Goals and aims (interests, quality of teaching, conformity, etc.).

   (d) Relation characteristics (innovator, explorer, active, passive, leader, follower, etc.).

The scheme outlined above delineates a complete set of parameters for demand analysis (market segmentation and description). Depending on the particular market involved

some parameters may be more important than others. Also, broad segments may be developed initially and more specific requirements introduced subsequently.

The usefulness of the scheme lies in the fact that it may serve as a basis for both market segmentation and description and for structuring of the knowledge marketer's "product That is, the scheme suggests a way of describing the market in terms of the kinds and forms of questions that consumers may ask and that together comprise the demand for knowledge in the educational epistemic community.

In sum, the scheme outlined above can serve as a basis both for demand analysis and categorization and as a basis for a storage and retrieval system "fitted" to the market involved. Moreover, while the parameters developed above remain constant, the questions and operational specifications listed under each parameter can be changed as need arises. A knowledge utilization system developed along these lines need not, therefore, become a closed training system. It can (depending upon the knowledge marketer's competencies and preferences) facilitate diachronic relations among knowledge suppliers and consumers.

Supply of Knowledge

The preceding discussion was based on the assumption that there exists effective supply and demand of knowledge in the educational epistemic community. In view of the evidence to the contrary (cf. Research Memorandum #6), it is necessary to relax this assumption. Two issues then arise:

1. If a substantial part of the "knowledge" developed in education takes the form of answers to questions that educators do not ask then the knowledge marketer may need to intervene in the supply process in some way.
2. If a substantial number of potential consumers do not ask questions either of others or of themselves then the knowledge marketer may need to intervene in the demand process in some way.

Intervention in the supply process may take one of at least two forms. The knowledge marketer may seek to commission studies and research to answer particular questions. That is, he may seek to "market" questions. Insofar as there exists a demand for questions among educational scientists this form of intervention may be very effective without necessarily resulting in a closing of the knowledge utilization process involved. A demand analysis similar to that described above, but aimed at suppliers, should enable a categorization of suppliers on the basis of interests, competencies, and communicative characteristics.

The knowledge marketer may also intervene in the supply process by transforming or translating existing "knowledge" into usable forms. One might hypothesize, for example, that one reason learning theories have found a limited market among teachers is that their practical implications are obscure. Imaginative "embodiments" of alternative theories may make them more relevant to the practitioner (cf. Pilot Study #7).

Also, if indeed practitioners operate from "folklore" rather than from a "scientific" stance, the restatement of "scientific" knowledge in folklore form and terminology may enhance the practitioner's ability to be communicated with by "scientists."

There are thus a number of ways in which the knowledge marketer can intervene in the supply process without necessarily controlling the process. Indeed, the only form of control that the knowledge marketer need exert is that inherent in his efforts to orient the supply process to consumer needs. This orientation of the supply process can never, of course, be complete, nor should it be complete. The knowledge marketer's ultimate performance criterion is, after all, not the degree of consumer orientation of the supply process as such, but the quality of the interactions among educational scientists practitioners. Consumer orientation of the knowledge supply process is postulated as a means to that end and not as an end in itself.

Selling Knowledge

Insofar as a substantial number of educational knowledge consumers (scientists or practitioners) fail to question their own assumptions and practices (whether by asking others or by asking themselves) the knowledge marketer may need to intervene in the knowledge demand process. Efforts to translate supply into the "language" of users have already been mentioned. In addition to modifying the supply process such efforts should also influence the demand process since that is the rationale for such efforts.

More directly, the knowledge marketer can intervene in the demand process by means of promotional or selling activities. Promotional activities are strictly tactical means. If the product (knowledge) cannot be transformed or modified to "fit" the communication competencies of consumers, then promotion of knowledge utilization will be ineffective. The possible "barriers" to knowledge utilization may be roughly differentiated in an order of increasing strategic importance as follows:

1. Lack of awareness. Lack of effective knowledge demand may to some limited degree be due to nothing more than a lack of awareness of the availability of particular sources on the part of potential consumers (but cf. Pilot Study #1).
2. Negative attitudes to knowledge suppliers. Lack of effective demand may be due to particular or even culturally supported attitudes or predilections to ignore or even oppose questioning of assumptions and practices. This phenomenon occurs among both scientists and practitioners.
3. Organizational or bureaucratic constraints. Lack of effective demand may be due to intra-organizational factors of a variety of sorts. Strictly defined lesson plans, tightly controlled teaching schedules, and enforced conformity to "official" assumptions regarding the nature of learning are examples of such organizational factors. Where such factors are found the knowledge marketer may have to sell

knowledge utilization to those responsible for the maintenance of these organizational characteristics before he can sell his services to primary consumers.

4. Lack of competence. Lack of effective demand may, finally, be due to a lack of competence on the part of potential consumers to generate questions and utilize answers regarding their own assumptions and practices.

Each of these "barriers" represents different selling problems for the knowledge marketer. A variety of promotional methods and techniques already exist. Many of these have been known to be reasonably effective in creating awareness, changing attitudes, and even in overcoming certain barriers rooted in organizational designs and relations. How effective a knowledge marketer's promotional program can be depends, significantly, of course, upon the kinds of barriers to interaction in the interest of knowledge utilization that exist in any given epistemic community. In short, an assessment of the promotional opportunities in the educational epistemic community with respect to knowledge utilization depends upon a thorough demand analysis.

This is not the place to engage in an elaborate description of available promotional methods and techniques. A number of books and articles are available which adequately describe these methods and techniques. Also, there is a large variety of marketing and advertising agencies whose experiences in selling technology would seem directly applicable to the problems of selling knowledge.

Organization of Knowledge Marketing

The previous discussion has been based on the assumption that the knowledge marketer comprises a single corporate unit. This is clearly a limiting assumption and one which may need to be relaxed. There exists already in any epistemic community a communication network which neither can nor should be replaced by a centralized knowledge marketing agency.

Indeed, a knowledge marketing agency may find it advantageous to operate through existing channels and agencies. Journals, newsletters, libraries, and book publishers are examples of such existing agencies which might serve in some "retailing" capacity for the knowledge marketer. Insofar as some members of a given epistemic community are more likely to use certain media and agencies rather than others, a knowledge marketer may advantageously seek to augment the capacities of these existing agencies rather than developing duplicate facilities.

Also, insofar as there are specific "opinion leaders" within particular epistemic communities a knowledge marketer may find it advantageous to give special attention to their needs. Also, effective disseminators (e.g., textbook writers and speakers) may be better media for the purposes of knowledge utilization than print or electronic media. If so, a knowledge marketer may find it advantageous to augment the capacities of such individuals as inquiry systems rather than, or in addition to, employing more generalized media.

It is clearly not possible here to anticipate all the

opportunities that exist for a knowledge marketer to enhance the quality of the knowledge utilization activities within any given epistemic communtiy. Any reasonably complex demand analysis should reveal many such opportunities. The crucial point in the search for such opportunities is the maintenance of a consumer orientation. It would seem a safe assertion that the most important issue in knowledge utilization is neither the formulation of storage and retrieval systems, nor the transmission of "knowledge" to potential users. The major issue would seem to be relevance--relevance to the consumer's problems and to the consumer's goals and hopes. Until a thorough and honest attempt has been made to relate the supply of knowledge to consumer problems and questions it seems rather arrogant, if not simply wrong, to conclude that the supply exceeds the demand for knowledge. Does anyone know that the reverse is not the case?

Summary

The aim of the preceding discussion was to develop an operational definition of the meaning of "demand for knowledge" from the standpoint of a knowledge marketer. Some basic concepts of marketing were outlined and the economic concept of demand was specified. Since the concept of knowledge does not afford an obvious unit of analysis (as does, for example, technology) a unit of knowledge was defined as any answer to any meaningful question.

Four different types of demand-supply situations were outlined and the concept of effective demand and supply defined. A method of demand analysis was then outlined and

described for the case of effective demand and supply. Some of the consequences resulting from a relaxation of the assumption that people actively demand and supply knowledge were discussed. Finally, some issues relating to the organization of a knowledge marketing agency were outlined.

It should be emphasized that the conception of the knowledge marketer's function advanced does not only involve the marketing of knowledge as such. Rather, it involves the facilitation of interactions among individuals as suppliers and consumers of knowlege within a specified epistemic community. Futhermore, the ultimate performance criterion proposed for a knowledge marketer is not the degree to which a given body of knowledge is "used". It is the quality of the interactions among the members of an epistemic community.

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Project: NCEC Knowledge Utilization Study

Research Memorandum #11:

"On Knowledge Utilization in Education: Some Strategic Explorations"

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On the basis of [illegible] reviews and assessments [illegible] work that has been done in the field [illegible] our own theoretical [illegible]tions,[2] and certain basic issues that [illegible] been raised indepen[illegible] we have concluded that:

1. The key problem is not that of "transfer" of information, but of certain fundamental paradoxes and inconsistencies between what we say vs. what we do in American education; and

2. It is illusory to talk about such things as "communication" problems in "knowledge" utilization in education, the "cost effectiveness" of informational resource systems, etc., before certain basic strategic decisions have been made.

In what follows we will try to explain how we arrived at these conclusions, to describe what their implications are for the National Center for Educational Communication, to propose some pilot studies which we anticipate will reveal both the efficacy of our conclusions and some promising kinds of redirections for the future, and finally to outline the general directions which we believe further research and application should take.

As a result of blind faith in scientism, as a result of the belief that enough money spent for enough research or enough technology will eventually bring the solution to any problem (the "Manhattan syndrome"), and as a result of the conceptual models that have most generally been used, many of those who get paid for "doing research" on "information transfer," or who get paid for trying to effect "information transfer," give the impression that the problem is mainly a tactical

"communication" problem. As a practical matter, this is understandable. But it is theoretically as well as empirically unsound.

Since the repopularization of "communication" in the last thirties, it has been commonplace to assume that the problem of getting other people to do what they should do is "only" a matter of communication. It is true, of course, that remarkable "progress" was made in U.S. agriculture both preceding and following the second World War. It is true, of course, that U.S. farmers are faster "adopters" of advanced farming methods and techniques than the farmers of some other countries. It may also be true, in part, as some have asserted or implied (Lionberger, Rogers, et al.) that this unprecedented "progress" could be attributed to "better communication." But there were a great many other factors. Land is distributed differently in the U.S. than in any other country; federal support, guarantees, and subsidies have been characteristic of U.S. agri-business since the thirties; the American attitude toward debt and credit for "progress" is probably duplicated nowhere else in the world; a disproportionate amount of all of the most tillable land in the world is in the U.S.; and so on.

If our historical and our research examples show us anything, it is that getting other people to do what we think they should do has never been a matter "only" of communication. There have always been a great many other factors, of greater or lesser importance.

In our review of the literature and our assessment of the "problem" of knowledge utilization in U.S. education, we have been forced to consider some of these other factors. We have concluded that the primary problem is not that of increasing the "transfer" of "information." We have concluded that the underlying problem is rather that certain paradoxes and

inconsistencies have been built into the way we look at and think about the educational enterprise, and that these orientations and their applied consequences will continue effectively to preclude any substantial or significant improvement in "knowledge" utilization within the enterprise until they are changed--no matter what technics are employed. We have concluded that it is this problem and these issues to which the major strategic efforts of NCEC should be directed, and to which we must direct our own efforts.

The complexities of the modern educational enterprise in the U.S. defy simple description. But something of the generic problems and issues can be described, and therefore dealt with tangibly and positively.

In the U.S., we have education by conscription. Even though "higher education" is not required by law, it has by default become "required" for all sorts of extra-legal but no less compelling reasons. But we have clung to "elitist" conceptions and ideologies. Because we have generally talked about education in certain ways, but have in fact developed the educational enterprise in quite different ways, we have created inconsistencies and paradoxes between the way we think about the educational enterprise and the sheer facts of life with which we endow it.

For example: We want "equality" but we also want "creativity." These are inconsistent goals. Creativity creates inequality. We want "order," but we want "freedom." These are likewise inconsistent. Freedom creates disorder (not necessarily a bad thing), and order necessarily constrains freedom. We want everyone to have "an education"--even a "good" education—but we also say that we want everyone to be all that he might be. But something which must be made available to, or forced upon, people universally cannot also particularize them. Our modern romance with the

notion of "equality" has led us to establish positive assurances that educational programs are not different--i.e., that they are standardized. But how can a program or a school or a teacher or their products be both standardized and unique? In the popular culture, if not in science itself, there is the belief that what is new is good, that what leads to "progress" is good, and that what does not is therefore "bad." Is something that "works" to be discarded just because it isn't "new"? We say we want to "humanize" education. But at the same time, a lot of money and effort--perhaps the lion's share--goes into the development of an educational system in which "no human action shall be required." A child's learning used to be his responsibility; now it is the responsibility of the President of the United States. Where is the research that shows distinct advantage to individual learning in gradually shifting the responsibility further and further away from those who are most directly engaged in it--the teacher and the student?

And so on.

Our view of the research which has been done on "knowledge utilization," "information transfer," "diffusion," etc., leads us to the conclusion that the "cost effectiveness" of "information" production-distribution-utilization systems will vary with the degree to which the enterprise is "closed." That is, the more completeable and determinate the task of the user (as in basic engineering), the greater is the "cost effectiveness" of the data ("knowledge") support system. This is so because it is only for tasks which are determinate and completeable that information requirements can be specified in advance. It is only for tasks which are both completeable and determinate that the "efficiency" of its data support systems is a relevant criterion.

The rather clear-cut implication that we see in this is that no purely tactical "communications" adjustments or alterations (changing the form of the data, reporting through a different "medium," etc.) are likely to meet with any more than trivial success or failure. Any information source has utility only to the extent it is accessible, relevant, necessary, and valid. By-and-large, ERIC (for example; most scholarly education journals for another) does not have these utilities for the average teacher.

Nor can these formal, subsidized data systems be imbued with these such utilities through "communication." The problem, the underlying problem, is not a "communication" problem as such. Other research has indicated that the "average" teacher does not, in fact, seek task-relevant data through any formal medium or data system.[4] One could try "selling" teachers on ERIC (again, as but an example of one kind of formal data support system). It is our hypothesis that teachers would not, generally, "use" ERIC even if they "knew" of its existence (which they apparently do not), and even if they were informed as to how it could be utilized. The study by Deans, described below, is intended to confirm this hypothesis.

If--and that is in this case a very large if--NCEC is to be committed to the goal of getting the extant "educational research" "utilized" by large numbers of teachers, then the first strategic task facing NCEC is that of indirectly and slowly changing the definition of "teaching." If "teachers" in large numbers[5] could be brought to define themselves and to conceive of themselves not as "teachers"--which is a very ambiguous term because of the American scheme of education--but as "learning engineers" or as "classroom engineers," then it would be feasible to design a data support sytem for "teaching" which would have a significantly higher

degree of potential utility. Some of the studies described below are intended to demonstrate that this change in definition is a feasible objective.

Short of this redefinition, given the nature of the existing educational enterprise and its political-ideological context in the U.S., no particular data support system, and no particular tactical variants within the system could be expected to have significantly greater potential utility than any other.

There is another strategic alternative. If--again, a rather large if--the goal of NCEC were shifted from that "getting" teachers (and others) to "use" extant "knowledge" to that of enhancing the competencies of teachers as inquiring systems, then we would hypothesize that there would be a significant increase in the utilization of existing "knowledge." However, we would also hypothesize that this shift of responsible initiative from the producers and suppliers to the users of data would bring with it a press for more and more varied sources (and forms) of data. In other words, there would be no reason to believe that ERIC (for example) would be any more "utilized" under those conditions by teachers in general than it is now, even though the rate of "utilization" of all data from all sources could be significantly increased.

Some of the studies described below also "get at" the efficacy of this aim, and at some of the research and practice implications of implementing it

It seems to us that these conclusions present a particular problem for NCEC, just as they reveal certain paradoxes of the U.S. educational enterprise. If the educational enterprise were to achieve one of its

fundamental reasons for existence--that of enabling people to be independent learners--it would become increasingly obsolete. We know that this has not happened. What is all of our concern about "adult education" except further evidence that the educational enterprise has failed significantly to make independent learners of its students. If NCEC takes the given situation as the ideal or most desirable one, whatever is done will play into the track which we are on by default.

The Office of Education should be the leading edge of any movement for the redesign of the educational system, not its trailing edge. The decisions-by-default that come out of the delusory posture of "scientific objectivity" do not necessarily benefit people.

The fact is that most teachers do not utilize any formal data system to "improve" their daily practice. Is this fact not to be respected by researchers and policymakers? Mightn't there be perfectly good reasons why this is so? Why do we assume that our notions of what teachers should be doing has more scientific legitimacy than what they are doing--in this, a democracy? How does it happen that the need to justify the "research" enterprise and its ideologies takes precedence over the facts themselves? There is nothing inherently moral or scientific or humanly benefitting about "more" or "better" communication. The immediate and only exclusively communication problem with respect to "knowledge" utilization in any social system is that of enhancing the reach or the grasp of the "user" of that "knowledge." All other problems have some extra-communicational criterion--social control, socialization, ideology, self-justification, etc. If there is to be some assumption that the data which are produced must be "useful" to large numbers of "consumers," then the only ideologically

neutral way of going about increasing the rate of "utilization" would be to constrain the producers to produce only what is specifically requested by the consumers. We have either to make the "knowledge" production-distribution-utilization system to fit the consumers, or to make the consumers fit whatever "knowledge" production-distribution-utilization system we think they should fit, or some combination of both. None of these is a "communication" problem as such.

Strategically, then, we believe that NCEC may need some better basis for determining what are and what are not "communication problems." Some of the pilot studies we plan to undertake will be useful to NCEC in developing policies for such determinations.

What follows are brief but sufficient (we believe) descriptions of several pilot studies, mini-research explorations, etc., which are intended to result in

A) Rather more specific recommendations to the Office of Education for long-range research and development activities pertaining to educational communication; and

B) Specific policy recommendations to the National Center for Educational Communication including but not limited to the manner in which some of the nonprint media might better be utilized in the overall design of its various efforts.

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5. The typical posture is to try to bring about "adoption" through those individuals who are "knowledge"-utilizers. But there are "mass" media, and an alternative posture--taken here--is that there may be even greater cost effectiveness in strategically reorienting large numbers of teachers.

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Project: NCEC Knowledge Utilization Study

Research Memorandum #12:

"Mass Culture and Mass Education:
A Review of Potential Mass Media Uses Under Varying Social, Political, and Cultural Conditions"

Originator: Hanno Hardt, Project Associate

Date: December, 1971

Distribution: Project Associates*

Research Assitants*

NCEC Officials

Practicum Participants*

Consultants

Contributors

Public Inquiries

The role of technology in knowledge utilization in education cannot adeqately be conceptualized if existing commercial communication media are ignored. This proposal describes an investigation which, though not empirical in nature, is felt to be a necessary preliminary step to providing recommendations about media use which appreciate the educational potential of this resource.

The investigation, to be conducted in conjunction with the NCEC knowledge utilization project, is part of a general discussion of social, political and cultural conditions for education in Western Europe outlined in Research Memorandum #4 (see appendix).[1] The proposed investigation will focus on the idea of education and teacher training as it has been raised, at least implicitly, by mass communication specialists in Europe and elsewhere in conjunction with the development of advanced mass communication technologies.

Consistent with the argument raised in the previously mentioned memorandum, it is held that historically education in Western Europe has been described as an elitist process of socialization. The idea of democracy as applied to education in this country and other Western democracies during the last century resulted in a misunderstanding of equality and, thus, produced an inferior system of formal education under the guise of education for everybody. In addition, the rise of industrialization and the prospects of a technological society raised questions about adequate, that is efficient and sufficient, training for those individuals who were to maintain and perpetuate the technology. This meant that education was replaced by training as a result of societal demands for specificity and definite goal orientations in the educational system. These demands had come to the

fore with the increasing feeling of ambiguity caused by an open social and political environment and its communication channels that promoted the desirability of more information about everything and more diversified methods of disseminating this information. The training for specific tasks, that is professionalization and specialization, was the answer to a period in modern history that provided an increasing amount of old and new knowledge but little, if any, guidance for the interpretation and use of this knowledge. This dilemma was described by John Dewey about 75 years ago when he wrote, "With the advent of democracy and modern industrial conditions, it is impossible to foretell definitely just what civilization will be twenty years from now. Hence it is impossible to prepare the child for any precise set of conditions."[2]

In establishing a difference between training and education, we are emphasizing the importance of conceptualizing education in terms of a theory of man as an inquirer and as an interpreter of knowledge, not only for his own particular needs and interests but also for the construction of relationships between himself and others in his environment. Robert M. Hutchins refers to this condition as liberal education, which he says must "lay the foundations for wise citizenship, the sensible use of leisure, and the continuous development of the highest powers of every human being. It must be the kind of education that will bind men together, not merely in this country but throughout the world; for a world order is emerging."[3]

Mass communication media are a phenomenon of the social and political process of democratization and industrialization of society. Their content necessarily reflects philosophical and social ideas and affiliations of individuals as well as external societal regulations of a legal or political nature. Without further elaboration at this time, it may suffice to say that

Herbert Muller's summary of the conditions of the electronic media, in particular, reflects the earlier argument about the application of the democratic concept to education in its extension to mass communication media. Muller feels that the mass media as exponents of mass culture share a common problem, since "mass culture is accordingly most troublesome for those who cherish democracy. For this is democratic culture, made available to all people, designed primarily to please the majority who are supposed to rule. It magnifies the perennial difficulty of reconciling the ideal of equality with ideals of excellence."[4]

Discussions of the involvement of the mass communication media in the educational process of a state or nation are neither new nor infrequent. In recent years increasing attention has been given to the role of television. Basically, the use of electronic media has been discussed in two different but related frameworks: in the context of media use for direct teaching and in the context of media use as a form of enrichment of existing educational programs or curricula in schools. According to recent discussions, some countries are shifting more time and resources to direct-teaching broadcasts, while others are still holding to use of radio and television as additional or supplementary sources of information and knowledge about the world.

Great Britain, for example, through BBC and ITA, features both approaches but uses television for most direct-teaching programs. France, because of an acute teacher shortage a few years ago and in an attempt to utilize the best possible teaching methods, has embarked upon a direct-teaching program. The Italian Telescuola is often cited as one of the most ambitious direct-teaching efforts, which was a response to the "necessity to supply the deficiencies of our educational institutions and the opportunity to step in,

when lack of instruction reduced the possibility of social evolution for part of the population."[5]

The Scandinavian countries of Denmark and Sweden support the enrichment approach in their use of electronic mass media. "Education in Denmark is on a level that does not make it necessary to have direct teaching in school radio, and our programmes are therefore principally to be regarded as supplement and enrichment and an incentive to the work of the teachers."[6] Sweden also offers enrichment programs, which are based on the philosophy that "schools have so far enough qualified teachers and that these teachers should always be the centre in any teaching process in which television and other educational aids are involved."[7]

The experiences in other countries are quite similar. Typically, direct-teaching efforts are greatest in developing countries or in countries with teacher shortages or problems of population density, for instance.

Given the current trends and conditions as outlined above, it is suggested that the investigation be designed to further investigate the educational uses of electronic media, particularly as sources of enrichment through regular programs offered by radio and television but also through those aspects of mass communication usually referred to as mass culture. Preliminary readings[8] indicate that most current concerns among educators and mass communication specialists are concentrated in the areas of student and teacher training through radio and television lectures and demonstrations. This approach is consistent with a philosophy of efficiency through fast training of technologists, but it disregards the development of individual interests and intellectual capabilities, the gaining of insights, and the understanding of ideological or social processes in society.

In particular, the study will attempt to find ways of using available mass communication technologies for the education of individuals within the

structure of the informal institutions of mass culture. It is hypothesized, then, that education is a broader concept than is described by the formal educational system, that it is based upon a democratic theory that stresses availability and accessibility as prerequisites to the development of man as an inquiring system, and that, therefore, legal and political manipulations of mass communication media must be rejected as attempts to perpetuate mis-education.

Given the different social, political and cultural environments from which the project will collect information, it is hoped that a number of suggestions pertinent to the particular relationship of education and mass communication media in the United States will emerge. Harry Skornia conceives of official and unofficial educational systems with differing value structures;[9] what is suggested here is a conceptualization of education that embraces all points of contact in the individual's environment and incorporates mass media content as one of the most important and highly significant stimuli. In this connection, a particular effort will be made to study the impact of political and legal pressures, especially through Congress and the Federal Communications Commission, on the electronic media in the United States in order to provide the basis for a comparative analysis with selected Western European countries. The work will include an investigation of current uses of mass media as educational enrichment devices, for instance, and a discussion of the problems of integrating the formal educational system more effectively into the informal educational structure of the society.

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Project: NCEC Knowledge Utilization Study

Research Memorandum #13:

"What Is Knowledge That It Can Be Used?"
(An Educational Inquiry)

Originator: Marc Belth

Date: 30 October 1972

Distribution: Project Associates*

Research Assistants

NCEC Officials

Practicum Participants

Consultants

Contributors

Public Inquiries

(Note: This is a short essay on a most complex problem, one which has a long history of analysis by some of the great minds of the Western world. Limitations of space and of time oblige me to be elliptical at many points and cursory at others. But to omit what I think are bench marks along the road of the development of ideas here would make it appear that I was writing outside of the context of the history of scholarship. To include more than I have would be to allow for digressions which would be tolerable in a large work and exasperating in a short one. My intention here is the analysis of some old formulations in order to suggest some alternative ways of considering this thorny matter. In order to accomplish this I must risk the exasperations rather than eliminate the hints at the locations within which the problem has to be considered.* Even more exasperating, perhaps, will be the fact that this essay does not concern itself with the puzzle of how to use knowledge, but with the problem: What is knowledge that it is to be used?)

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*I must acknowledge here the kindness and the penetrating questions raised by Professor Lee Thayer of the University of Iowa. The inadequacies which remain are in spite of his thoughtful efforts.

What Is Knowledge That It Can Be Used?

(An Educational Inquiry)

Marc Belth

Introductory--The Argument Stated

Knowing is not a substitute for thinking, nor is it a synonym for it. However, the role which knowing plays in the thinking act is an important concern of this essay. Others, deriving from this are distinctions that might be made between thinking and "fitting," and thereby between problem-solving and puzzle-solving, and the elements of each of these acts, and thereafter, problems of percepts, concepts, and their conditions. Further, if knowing is not a substitute for thinking, neither can it be treated properly as information. On these assumptions, and the distinctions drawn as consistent with them, hangs this essay.

Semantically, we use the term "thinking" as a true gerundive, though mental (rather than perceptible) in character. "Knowing" is not really used as a gerundive. "Knowing," rather, many have argued, refers to a state of being, an achievement, not a state of doing, an activity itself.[1] When we say that we know something, we are indicating a state, or a condition, akin to containing, possessing, or

being identified as having, something. Thus, "I know" suggests something of a state of affairs, or having a disposition for . . . a given age, a given weight, a given height, a given talent. But "I think," if it means something more than just "I believe" (which is, again, a state of some kind) means "I infer," "I reason," "I conclude," "I argue." Each of these terms suggest not a state but an active process I am capable of performing on certain matters, generally symbolic in nature, and that by means of this performance I am able to draw, or arrive at, certain conclusions. Thus, what I do with knowing will manifest the act of thinking, or as will become evident, be reduced to information.

The act of thinking has as its purpose the explanation of events experienced. Such explanations are those additions to complexes of knowledge which transform otherwise inert conclusions to instruments for use in later experiences. When thinking, we operate not on the world experienced but on the symbolic distillation of those experiences, and these symbolic distillations, as conclusions believed about experience, are what we call use-ful knowledge. These symbolic conclusions, formed into symbol systems which reflect, denote, or connote (or all three) the considerations of experiences, are at once the outcomes of thought, and the determiners of the next act of thinking, but they are not, nor can they be substitutes for that act. The character of knowledge is such that it contains within itself not only the deduced, induced or adduced outcomes of some inquiry, but it contains also the paradigm for continuing to think still further about other experiences arising. In this sense, then,

I shall argue that all knowledge is paradigmatic in nature, and although knowing is not itself the act of thinking, its structure provides for the thinking act, the guideplan, the blueprint, the methods to be followed in inquiring into the world beyond the knowledge present to us. And this, I shall show, is what is meant by "the uses of knowledge." (By contrast we can distinguish between thinking, or problem-solving, which is the using of knowledge, and what often appears similar to it, but is better identified as puzzle-solving, which is the using of information.)[2]

In the analysis which follows, and which is intended to vindicate these assumptions, we shall have to explore as much as we can of the elements which are involved in this state and this activity. We shall have to look at the roles of sense-data, of perception, and of concept-formation and concept-use. We shall have to examine the various conditions of a given conclusion as it is transmitted to us, or as we attain to it. We shall have to distinguish the various forms which we find in those conclusions, some of which will fulfill the status of knowledge, and some of which will be short of that state, and must be recognized only as information. Undergirding all of this, we shall have to examine behaviors which are intrinsic to the thinking act, paradigmatic approaches, and especially the behavior of metaphor-making and metaphor-using, both of which will be seen as basic to thinking. The latter appears as the context (metaphysical, perhaps) of all that we come at last to claim as knowledge, in its fullest paradigmatic operation, which is the actual methodology of the thinking act.

At the conclusion we will address some comments to the problem of education, and how it differs when the primary purpose is seen as the transmission of information and when the primary purpose is seen as the generation of powers of thinking, the use of knowledge.

I

Metaphors[3] and Paradigms[4] in the Use of Knowledge

The normal classroom's activities have been disrupted. A game designed both for fun and for learning has suddenly ended with children running about the room, hitting one another at random. To the common-sense view, one child seems to be at the heart of the mêlée. Order needs to be restored so that the work can proceed again. The teacher wants to know why the fight began. He begins to inquire. The simplest act conceals (or reveals) the teacher's primary model of the inquiry, and the knowledge or information, on which he operates. It becomes more explicit in the questions he puts. However ordinary the questions appear, the talk is special talk, and the questions asked imply the paradigm being employed. "Who started it?" "Billy did." "Billy, did you start it? Did you hit Sammy first?" "Yes!" "Why did you do that? Did he say something or do something that was not fair?"

The common, even simple assumption of a genesis of behavior and ensuing development from that genesis, is employed. Cause must be located, effects evaluated, and some modifications produced. If Billy answers only "because," we are not satisfied. We look for better causes, either internal or external. Was there something in

the game? Some threat to ego? (Note the term.) Some uncontainable frustration? (Again, note the term.) Was it internal to the boy? Is Billy tired? Did he have breakfast? Did his daddy punish him? Did he sleep well last night? The knowledge of Freudian language contains within it the paradigm for inquiry; the greater the knowledge, the more detailed the paradigm as used. Or, perhaps the game is beyond Billy's stage of conceptual development? Try some simpler tasks with him, and look for the level of his perceptual development. Piaget has offered variations on this. Check him again for details. Here the Freudian paradigm is extended, even altered somewhat.

In principle, the above paradigm is quite clear to the well-trained teacher. It is the paradigm constructed from the findings, the knowledge derived from genetic psychology. (To the teacher who has accepted Freud without any further questioning, there is no problem, of course, only a puzzle.) Which words would supply the "fit," the solution to the broken pattern? However complicated, the disturbed totality can be restored with the finding of the right piece in the Freudian (Piagetian) puzzle-solving box. There is, here, a first clue to the distinction between problems and puzzles, between data and perceptions. But more immediately, we must look at the function of concept systems.

Undergirding this and sustaining the paradigm, as a set of primitive terms, is a basic metaphor which sustains the structure and the order of the beliefs about nature and human nature. We assume the evolutionary character of genesis and development, of the

cumulative passage of states of events from earlier to later, from simple to complex. So the metaphor provides us with a deductive logic, and the paradigm directs the empirical inquiry.

A different metaphor would probably, but perhaps not inevitably, have provided for a different paradigm of inquiry. (This curious fact will be explored later.) Suppose we held as primitive, as many do, that human organisms are, after all, mechanisms, that is, machines. What sets one child off into a disruptive act, breaking the already established program of behavior of each of the children is some stimulus which this little machine has no means for sorting out and responding to successfully. Once this is apparent, the degree of the reaction is measured by the intensity and the endurance of the stimulus, the input. If we are to control and alter the situation, we must look into the stimulation level of the game and the capacities of the children (mechanisms) to cope with such inputs, among others. We must check in children for (chemical?) volatility, range of energies which might be expended, ease of transmissions, level of the powers of communication, clarity and comprehension of the symbols being employed, and on and on. What we need to do is to sort out the physico-chemical valences in the various parts of the game, and of the various energies intrinsic to the children involved.

Now this metaphor does not contain a genetic thesis, but rather a thesis of the function and structure of the electro-chemical flow of energy among children and the instruments in use. And the paradigm is what we have come to identify, to the level of our understanding and skill, as the scientific method of inquiry. The goal is not simply

the restoration of serenity, within which growth may occur, but the modification of the behavior of Billy, and the reinforcement of that behavior in order to increase its correctness as it continues to be reinforced.

Thus, again, a sample of how, in the classroom, we conventionally utilize knowledge. Why should there be any dilemma about this? Is it, perhaps, that not all knowledge is of this form? Or that we need to be more certain about what we may call knowledge? Is there a kind of knowledge that does not so readily present itself as usable as a paradigm of inquiry? Perhaps a knowledge of the past, say, of history, or of anthropology, or of mathematics? Can we, then, distinguish the knowledge which lends itself, even as it is formed, to such paradigmatic uses, from the knowledge that does not? If there is "knowledge" which does not so lend itself, is it judicious to call it knowledge? Is there a kind of knowledge-for-its-own-sake that does nothing more than improve our personal perceptions, disclosing to us the loveliness of the world, but which otherwise serves no real, functional purpose? Are there still Minivers among us, who see knowledge as a shining ornament of great minds? We really will need to explore not only the meaning of knowing, but theories of perception, and the nature and function of concepts and concept formation. Wasn't this behind the Whiteheadian polemic that knowledge-as-such has always been useful, for St. Augustine as well as for Napoleon? Perhaps there is much to be gained by distinguishing, within such experiences, between knowledge as used, and information as displayed and cleverly inserted for

greatest effects (on occasion, even in the classroom.) In short, can we call Whitehead's "inert ideas" knowledge at all?

II

What Is Knowledge?

Clearly, the question of the utilization of knowledge requires extended consideration. And with it, some consideration must be given to prior questions on which answers here must surely rest. Here are the classical questions:

First, what is knowledge? Second, how do we attain to knowledge? Third, what can we know?

These three are the substance of a vast bibliography. They have been relentlessly pursued in analysis by philosophers, especially in this century. The student of the field can retrieve out of his memory some quick information, distillations of the culmination of such analyses. And yet the answers do not, in the form of the questions above, promise readily to allow us to come to grips with the problem before us, for they assume the clarifications we seek.

For example, the first question is answered by distinguishing three kinds, or levels, of knowledge. There is the knowledge of what is the case. (We can know that, says Gilbert Ryle.)[5] There is the knowledge of how to do something. (We can know how, Ryle says, again.) And we can know by acquaintance, says Russell.[6] In a very different vein, we always know more than we can say at any given moment, says Polanyi, arguing for tacit knowledge.[7]

From this distribution, at least the second of these responses does seem to have built into it the matter of use. To know how to do something entails a knowledge that is put to use at the moment of demonstrating that one has such knowledge. I know how to ride a bicycle, draw a straight line, read a book, operate the electronic microscope, repair a disconnected doorbell, determine the molecular structure of this unknown before me. But unless we are able to make some connection between this form of knowledge and the other two mentioned, showing that the connection we make is ineluctable and indivisible, the problem of the use of knowledge, generally, remains for us. Indeed, we are left with the serious dilemma of not being able to distinguish between knowledge and information. On the face of it, no distinction is even intended. Yet this particular matter has occupied many thinkers in recent years.

(a) It is argued by Ryle that in order to know how, one must also know certain thats. (Though the reverse, he says, is not the case.)

(b) It is argued that tacit knowledge, in order to be explored and evaluated, needs to be transformed into a series of conscious statements, a series of knowings that such and such is the case. (From Polanyi we have the implication that we need to make the tacit explicit in order for it to be available for conscious use. Thus, the difference between using and being used by knowledge.)

(c) Common sense has even argued that, while it is possible to know how to do something without knowing what it is that enters into the doing, we can set this apart as a kind of low-level knowledge,

or, better, the effects of training, of mere habituation. In this case we do have a movement toward knowledge-for-use, for high-level knowledge is said to combine knowing what to do because we know what is the case, explicitly or tacitly.

The second question, of how we attain to knowledge, specifically requires us to explore and analyze problems of perception and concept formation. This will lead us, in Section V, into an important further dimension of the character of knowledge, and the less complex character of information.

And, as to the third question, of what we can know, this, too, has a thorny history. If we were to assert that we can know only what is true, we should have pronounced an oversimplified truism, and thus become involved in circularity. For, in order to vouch for knowledge, we should have to prove a truth, and to do that, the claim itself (that statement X is true) must be put to use. Thus, logically at least, what we can know is what we can put to use. But that, as I have said, is to presuppose, out of a logical process, what we are trying to prove empirically.

So the problem persists beyond these definitions which are available to us. Even the notion that knowing how has built into it the characteristic of using what is known still leaves us with open ends. For, there still appears to be a problem of the status of what is known (and thus, what is to be used in a given context.) For truths change when the contexts as well as the modes of inquiry continue to change at their many levels. And these contexts are themselves problematic constructions, not merely fixities which

serve as puzzle-dictionaries. Billy, in our example, may produce a different kind of disruption on a later occasion, designed to anticipate and offset the questions he was asked some earlier time. (His knowledge of them and the consequences of his normal answers, alters his later responses.) The continued refusal to answer any of the questions we put to him obliges us to call on different sets of knowledge from those which we have been using until now. Perhaps even the rest of the class may decide to protect Billy and, knowing the answers we are looking for, may give them all, in complete detail, without being at all concerned with whether they tell what in fact is the case with Billy. That is, in the closed context of a particular paradigm, they may all be logically true, yet no longer pertinent to the particular case. The very fact that they fit our expectations, are coherent with the knowledge we are seeking to use, misleads us into accepting them, and therefore, missing the development of some firmer resolutions we are actually after. Again, the hint of the crucial distinction between using knowledge and fitting information (solving a puzzle).

Do we get out of this dilemma by the use of lie-detector tests? Is the truth to be found in Billy? In the setting itself? This is not so absurd as it might seem. It is the heart of realism. If it is absurd, it is no more so than what is offered in a similar vein to another phase of the same matter. For we often assume, inadequately, I am convinced, that the problem of the use of knowledge is not so much that it, knowledge, changes but that we do not have the proper knowledge available to us when it is needed.

("Is it relevant?" is, in principle, the same kind of a question as "is it available?") To the latter we have committed ourselves in developing whole systems of information retrieval. And this, like the matter of relevance, is a matter which depends upon the acceptance of the status of knowledge which we are in fact trying to analyze. For, behind the fact of an information retrieval system, fully developed, is the idea that knowledge is storable, fixed in its form, usable as soon as it becomes available, and is independent of levels of human perception.

The trouble with this is that all of our concerns are being viewed as puzzles needing solutions. What needs to be known, and then done, is already, in some form, more or less complete. For us, however, at the moment, some pieces of the solution do not readily appear, are not readily recognizable. This is what creates the puzzle for us. We need to find whatever is required to complete the picture, fill in the empty spaces, bring the whole to rest. But if we are to pursue this concept of knowledge as it is distinguished from information, then the faith that resolutions already, always, exist needs to be suspended. Solving of crossword puzzles, or winning prizes on quiz programs is very different, cognitively, from solving problems. The instrument that will enable us to retrieve the information that allows us to fill in the blanks sees knowledge as a curiously fixed structure. Problems, Kuhn argues, are very different kinds of events, predicated on very different assumptions of knowledge.

An education which is designed to nurture puzzle-solvers has

been, in recent years, recognized as a severely limited education. Indeed, an illustration of the curious, if perhaps amusing, confusion about puzzle-solving was the charge that chess-master Bobby Fischer and his entourage had enlisted the uses of the most advanced computer they could find in his recent contest with Boris Spassky, and intended to feed the machine with the precise notations of the position of the pieces on the board after each move. The machine would be expected to make lightning computations of all of the possibilities available, and to send back the information of the proper move to be made. Not Fischer's use of knowledge, but the machine's delivery of information is to be the basis for a chess victory, and that, it is clearly implied, would not be a true victory. Which is more curious than ever, since what is being hinted at is that Fischer ought to depend on his own memory (or his own storage of information?).

All of this, it must be observed, is predicated on the assumption that knowledge has the status of being coherent, independent, discreet, forged into shapes which fit the spaces of all experiences to come. It is a body of statements brought out of the fires of personal experience, shaped, hardened, and objectively validated again and again in simulated experiences. New events may demand we reconstruct those shapes, or bits, because of human inadequacies, but knowledge is, by its very nature, independent, and thus matters for use, in the sense that they, the bits, can be fitted into spaces for which they have been discovered. Somehow, one cannot

escape the thought that the character of knowledge is too simply conceived in this naive form.

Yet the metaphoric conception set forth above, admittedly crude in the way in which I have presented it, does have attachments to continuing views of the function of education. Unhappily it serves as the very basic approach in most of our schools. In fact, the metaphoric character has been so hardened that even the process-oriented educational theory of John Dewey has been transformed into a puzzle-solver preparation of all who come to learn. It has become our most fundamental educational myth. Do we need to rest with this? Perhaps, perhaps not. Perhaps we need a more protean base for the analysis of knowledge.

I think that we need to examine, not so much Dewey's, or anyone's metaphor, but the role which metaphor itself plays in the character and the development of a conception of knowledge. We can observe at the outset that it plays a persuasive role, in addition to providing the active context of knowledge, making it logically impossible to speak of knowledge without also speaking of action, or use. We have already seen in the earlier illustration that both knowledge and information anticipate use. But we need to distinguish the use we make of information which enables us to solve those puzzles of man and nature that derive from one metaphor of reality, and the use we make of knowledge to construct and to resolve problems created by the inadequacies of given metaphors of reality and paradigms of inquiry in the world which we experience. We need a distinction which will hold for so-called

humanistic information and knowledge as it does for scientific. For science is no less, and no more metaphoric in its foundations, and no less, but no more paradigmatic in its traits than is literature, history, the other arts, or plain common sense. The difference between the variety of knowledge that we put to use lies not in the fact that some are metaphoric and paradigmatic, while others are not. It lies only in the fact that in some metaphoric systems knowledge, in its contexts and traits, are matters of especial conscious consideration, while in others it has been reduced to devoutly held myths, and move us to responses in ways which the myths themselves ordain. We become satisfied by those myths which sustain us.

It is important, then, to consider the character and function of metaphor, but it will be more significantly done by considering paradigm first.

III

Instituted Paradigms

(a) Thinking as the knowledge-providing act.

Dewey's pragmatic formulation was a direct effort to improve the prospects for effective education on an increasingly wider level. In his new model he sought not only to extend education to those for whom it had long been considered too lofty, but also to extend and deepen awareness or comprehension of the relationship between the intrinsic character of education and every conceivable human experience. He was looking for a resolution of

the problems left over, too, by intuitionist conceptions of knowledge; that is, of knowledge viewed strictly as an adornment of some internal arena called mind. Nor was he any better satisfied with that model of the world where nature and experience writes upon the mind, while intrinsic cognitive powers move the body in the direction indicated by the independent experiential writing itself. Above all, he was concerned to alter the Cartesian notion, (which became, curiously enough, though in a very different form, basic even to Locke) that the extended empirical world and the world of mind come together in the metaphor of some (glandular) switchboard at the base of the brain.

In the context of that altered formulation, the separate elements of utilization and of knowing were gaited to one another, seen to determine one another, and thus were transformed into a single problem. In the Deweyan metaphor knowing is itself an outcome. Thinking is an act. Thinking, in fact, becomes, for him, the utilization of knowledge. But, what came so hard for those who saw the known as independent of the knower, he saw process as the necessary propadeutic to some product, that product being determined and defined by process. Thus, knowledge without prior act is not knowledge at all, but rather inert data, residing in some reservoir, in some symbolic form, and better identified as information which might be shaped into knowledge only in some forge of direct experience, both perceptual and/or conceptual. In Dewey, then, we have cause to distinguish knowledge from information, problem-solving from puzzle-solving.

But we need to move forward somewhat, and examine more critically what could possibly be meant by this idea that knowledge is completed in action, and that thinking is the act of using knowledge, that the known is the paradigm of action only for some knower.

(b) Hypostatization in knowledge

Every formulation of this problem, whether it be as old as Aristotle and Plato, as medieval as St. Augustine, and later, St. Thomas, as more recent as Descartes, Kant and John Locke, or as most recently, in Dewey, Bertrand Russell, Ayer and Ryle, rests on metaphors which give shape to the basic theses of each philosophy. Each one inevitably treats knowledge as a methodological outcome, the method itself becoming the paradigm for its achievement. They differ fundamentally in the root metaphors each uses to define and explain the traits and functions of that knowledge, and as these differed and became institutionalized in some method, the paradigmatic aspects of knowledge came to differ too. Within these metaphoric institutions whatever is "built" into the concept of knowledge is given unique definition, explained in ways consistent with the metaphor. Thus, as institutionalized, each develops into a conceptual structure, within which sense-data the sense responses, perception, concept-formation, cognition, are woven together into a system, into a systematic consistency. I will have much to say about sensing and perceiving shortly. I need, first, to offer a firmer statement on a more general concept of knowledge, the role of theory, and the models by which a given theory is carried.

Any epistemological theory, I have suggested, will entail implicitly or explicitly, positively or negatively, a theory of use, that is, of the use of knowledge. It will also address itself, somewhere along the way, to a theory of transforming concepts into perceptible data, with the evaluation of the use of those perceptions, and the limits of its modifications when anomalies arise. We have come to discover, in modern times more cogently than ever, that the methods which constitute both the sciences and the humanities are actually operant in the perceptible instruments of some theory of knowledge. In this way we can recognize the logical and epistemological basis of every discipline, from anthropology to physics, to psychology, to the sciences of communication.

Whatever a theory may be held to be, (a general rule; a basic assumption; a statement of irrefutable truths which serve as the grounds for any further investigation of reality; an organizing principle by means of which we are able to ascribe meanings to data, to explain what we are exploring, to offer interpretations of otherwise uninterpreted data, etc.) its necessary employment waits upon some mode of transforming the theory into a model of use of some kind.[8] The likeliest and most familiar (though not the only) form that such a model takes, I have argued here, is that of a metaphor. For it is by means of the metaphor that it can actually be handled, put to use, made functional, observable, or controllable. Sometimes the model is of a concept which makes for special dilemmas of evaluating the conceptual solely by means of the perceptual. Sometimes it is of some existential event,

the model for which has been chosen, or constructed, on the grounds of similarity in appearance or in function or in the outcomes which can be measured against each other. The problems which arise here may seem to be simpler of resolution because of the greater accessibility of the model and of that which is being modeled, but the basic issue is the same. The relevance of the model, seen as a metaphor, to that which is being modeled is a matter for careful consideration, for analysis and experiment take direction from the models employed.

So, a metaphor, in order to be made usable, must be hypostatized into a systematic account of the world of our encounter, or of the "conceptual" world we have postulated as serving the condition of the existence of that world of our encounter. That is, in this last case, it must be reduced from a theory into a tangible theoretical model. Even when we use one event metaphorically to explain another, we have theoretically advanced a percept so it can be used, either as a replica or as an analogue for the event to be explained. This is the heart of the operation we call the "use" of knowledge. Anything else is just gap-filling, and the filler is information.

But in this view, we can see that using knowledge is, clearly, a good deal more than just a matter of applicability. The metaphoric conditions susggest that we need also to consider the ways of assuring that the metaphor, (and the reification being employed is apposite to the novel event), and that the application itself will be responsive to being evaluated through added instances and

counter-instances. More important, since the knowledge which we attempt to put to use comprises the conclusions of past inquiries, and the conclusions of those inquiries derive from the imaginative use of metaphors, metaphor analysis itself becomes crucial. Indeed, the application of either beliefs or knowledge depends upon, and is directed by the conceptual fixities which are alive within the metaphors with which we approach, in order to probe the materials we are now concerned with. The metaphors themselves give rise to the paradigms which have become the normal, or standard, agreed-upon ways of using knowledge to confront and control what appears before us. In greater or lesser detail, the paradigms contain rules for either investigation or comparison of what is known with what is yet to be known. They will make predictions possible, they will bear within themselves the means for the evaluation of outcomes, systems for sorting out relevancies from irrelevancies, for they are the operating rules of the reified metaphors of explanation and interpretation of the world beyond them.

Anomalies which occur during such explorations produce dilemmas for the paradigms, and for the metaphors which undergird them. The processes by means of which we come to learn about the world have been found, for the moment, to be inadequate to the data, and to the perceptions put to use. The conclusions of past inquiries available to us are not adequate to the developing awareness of data in the inquiry to be pursued. Additional procedures and instruments are required. The paradigm must be expanded, refined, shored up, reconstructed, in order to make an explanation and interpretation

of the intractable data possible. In short, the knowledge being applied in the inquiry needs to be expanded, altered, or modified in some way, and this is, itself, part of the use of knowledge. A new paradigm needs to be developed, and this obliges us to consider the very metaphor on which it rests.

Consider again the classroom behavior of Billy. The metaphoric basis of Freudians and Piagetians share the same genetic, evolutionary vision of the growth and the development of children. But each uses a different paradigm of inquiry into a given dilemma, Piaget more explicitly empirical than Freud. On the other hand, it is a matter of genuine curiosity that Piaget and Skinner will quite likely use similar scientific paradigms of the employment of their metaphors, but it is their metaphors which are dramatically different, as we note in the differences in their goals, their visions of proper purposes and outcomes.

It is when the metaphor is not questioned, or even identified, that we find that information is our concern, and the resolution of some puzzle our objective. But confront the different metaphors of Skinner and Piaget and the whole question shifts from solving a puzzle of Billy's behavior to what knowledge is valid in the problem in which Billy is an element, and to the need to show that this is, indeed, a fair statement of the problem of anticipations.

IV

Percepts and Concepts

Let us move to a more direct consideration of the transaction between man and his surroundings, the improvement of each of which

must surely be the reason for any concern with the utilization of knowledge. Clarification of this will enable us to come to terms with different views of the uses of knowledge. In so doing we find ourselves involved with two worlds, one of which is inevitably entertained as the model of the other. The world of objects, of data, is tangible; the "world" of concepts has no such status. But, I have argued, in order to make it possible to "handle" concepts, we construe them as metaphors of the object world. Thus, we find it easy to construe conceptual, or linguistic, or ideational "forms," "structures," "traits," normally discernible in that other, objective realm, as easy (or as magical), as imagining one thing as being something else more familiar. If the world of ideas is not acceptably considered simply as a mirror reflection of the tangible world, we are nevertheless in the habit of using the evidence of the tangible world as models for organizing, giving direction to and providing the fund of meanings to that evanescent "world" of ideas.

We need not be detained by the possibility that we have it all in reverse order, and that the conceptual is, after all, the real world, while the perceptual is the metaphoric, as Plato held, and as Idealists from that time on have insisted. The argument over logical precedence and its relation to functional precedence inevitably produces paradox, for either insistence must explain the determining role which the other plays in validating its own case. To argue, as some have, that concepts are logically prior to percepts, but that perceptions are functionally prior to concepts, makes for--among other things--interesting argument about which is

the metaphor for which. Perhaps we might be content with the even more curious fiction that it does not much matter, after all; that metaphor and reality so intertwine that it is hardly possible to distinguish these two worlds with all that much precision. Only Occham's sharp razor separated them permanently, but confused as much as it clarified.

The computer is widely accepted as an analogue machine; that is, an analogue of mind at work. Yet, just as frequently we accept the idea that man is (an analogue of) a machine. The greater danger comes, not from a preference for entertaining either of these metaphors, as opposed to the other, but from, for example, the Skinnerian-like insistence that he is not dealing in metaphors at all; that man is, in fact, a machine. For, even if Skinner does not have a particular "machine" in mind, to which he compares man, insisting rather that man is a machine, discernibly functioning as machines do, it is inevitable that he has some concept of MACHINE as a classifying and explaining term, in which we find a range of different members, one of which is man. In that case, all machines which we come upon are variants of the symbolic, or ideal Machine which can be described in some sign-symbol relationship. And this is metaphoric, after all.

There is a problem of long standing here, which has crucial relevance for us. It is the problem of the relation between naming (events to be known) and knowing, which leads, unavoidably, into the problems raised by the need to distinguish between: (1) the phenomena of nature, (2) our perceptions of phenomena, and

(3) the character and role which concepts play in the relationship between data known and perception (knowing). The critical and necessary distinction we have been making between information and knowledge is further supported in this distinction between data, perception and concept. By means of these distinctions we might see, for example, that what we really have been concerned with has been how to use information that is available--information which is distinct, disengaged, complete in itself, but which is without direction so long as it is devoid of an explanatory component. Explanations turn out to be paradigms for making connections between events experienced and conceptual systems. And explanations are theoretical (conceptual) in character, not datal, or perceptual.

Science is, even now, often described as the act of classifying all that exists. In the view of the naive realists this critical scrutiny of things as they are is accomplished by the very classification system into which nature itself falls. But if this were all that were needed for denoting the distinctions among the matters of existence, then the data which appears to the senses are, of themselves, the perceptions we have.[9] We would never be wrong in our perceptions, even when we disagree among ourselves about where data belonged, and what name should be given to them. Man could be defined as the recorder of the distinctions in the natural world. (Which is only a minor variation of the Lockean theme of man's blank tablet of a mind, on which nature writes her names and functions.) And knowledge would be but another word for information.

But beginning with the challenges raised by Berkeley and by Hume, we find it increasingly difficult to find in nature the representative data for such names as "worth," "proportional to," "intense," "causality." Yet it is terms such as these which make possible perceptions which transform value-free data into value-laden perceptions, for they interpret the data into systems of comparative, contextual relationships. Moreover, without the acknowledgment of this distinction between phenomena in the world (including the phenomenological aspects of man as a part of that same nature) and perceptions of these phenomena, there is no way out of the solipsism which inevitably develops. Some further system must be introduced which gives credence to the data of the world, and to the act of organizing that data into consistent, meaningful percepts, and at the same time recognizes the need for distance, physical, psychological, philosophical; between the world as sensed and the world as understood, or interpreted. And all this describes the function and the character of concept-systems.

Without such distinctions we are continuously in danger of pursuing the perfection of science by giving all things names, and then being confounded by the paradoxes which nature itself produces when further probings lay bare the contradictions in nature itself, in its later phases of evolving. (As, for example, the discovery that the hard surface of this oak table, in more critical observation, is made of great spaces between continually, rapidly moving molecules.) But this distinction at least makes it possible also to distinguish between data, perception (the organization of data)

and that something else which is the employment of perceptions by conceptual (paradigmatic) means to issue as knowledge.

Consider the computer as machine again in this context. A theoretical description identifies it as an instrument which has been constructed to perform mathematical operations on the matters which it has classified. This classifying is an aspect of the program of work which it performs. Whatever it does can never be a complete surprise, since it can perform only according to the rules which have been embedded into the machine. If we are surprised, it is only because we have been inadequate to the speed or the complexity of the mathematical operations, but which are no "surprise" to the machine itself, or to the rule systems which define mathematical computations.[10] We are surprised in the way we are surprised when an unexpected deduction, or inference, is drawn from a familiar series of premises and operations. It was implicit all the time. We are only surprised to see it made explicit, as we are surprised by a chess move we had not anticipated, but which lay all the while within the rules and the logic of the game.

Now, this is obviously a curious description of what is more understandably set forth in common sense terms; but this is, after all, the way of philosophy, whose intent it is to offer a logical account of the empirical world experienced. So what the computer produces in its direct operations is information about mathematical permutations out of large numbers of data related together. It provides us with answers to puzzles which we have set for it.

Clearly, in our sense, the computer is not a substitute for

thinking, though it performs certain logical acts. Seeing this we can also observe that information is not a substitute for, or even a variation of, the knowledge which reflects the sorting system which the computer applies with such remarkable effectiveness. We may well discover, by means of such complex machinery, the behaviors of nature, and its further limits of possibility. But that is all we will have collected. Its use lies within an explanatory system that the machine does not provide, but which analysis of the machine's functioning might.

It is the root metaphor[11] with which we have begun which obliges us to believe that nature not only reveals herself more and more completely, but obliges us also to be guided by whatever it is that nature reveals, and, finally, warns us not to contradict what the data reveals. But data itself does not reveal. Concepts reveal to the perceiving mind. Somewhere in the involvement there is generated an awareness of the need to find firmer distinctions between the behaviors of nature and the values which that nature has, or lacks, in the experiences and the needs of men. Some other metaphor, then, must be at work, when it has become clear that what men perceive is a good deal more than the behavior of things, of the phenomena which comprise tangible reality. When men also perceive values, purposes, histories, tendencies, disruptions, continuities, relationships, alternatives, which are not in themselves reducible to phenomenal states, the limits of the "man as a machine" have been reached, and so has the metaphor of the "thinking machine."

Within its own metaphor the computer sorts, determines numerical values, weighs. All of these can be considered as part of an evaluative activity in that quantitative sense. But the machine is utterly bound by the logic which is programmed into its operations. It cannot alter this. When data resists the logical system, the paradigm of its operations, it does so because of the inadequacy of its rules, and not because it has challenged its own metaphor. It may even continue to function, but it does so by treating that data in the terms of the system with which it was constructed. (We can certainly specify human analogies to this kind of activity, but other, with more humanistic-sourced metaphors, generally identify such people as rigid, incapable of moving out of the orders imposed, the goals to be attained, or reductionist.) But when the data, or the demands made on the machine are not part of the original paradigm, are not given a reality-status by its primary metaphor, the machine is likely to come to a complete halt, or the gears might continue to run but nothing will be handled, sorted or computed.

Peculiarly, then, it requires men to construct such machines as will provide him with increasingly refined collections of information. Yet it is continuingly evident that it will be necessary to transcend the constructed logic of the machine when it is discovered that it cannot break out of its own logical restraints in order to take account of anomalies which continue to rise. So the machine itself has the value built into its logical range and processes. And it is the maker of metaphors and the builder of paradigms who is required not only to alter the logic of the machine

but also to transform whatever information comes forth as purported knowledge-for-use in experiences which the machine is not constructed to anticipate. (Indeed, can we ever claim that the machine anticipates the uses of its outcomes?) And is this not manifest in the mountain of information which machines pour out, and which have to be reduced and retrieved within other than information systems?

V

The Metaphoric Use of Data

Certain very important distinctions can be drawn from this illustration. First, we can identify the data which the machine accepts (or which an individual also comes to accept) as the name, or description of a material event, even if, in fact, that event is a delusion. Curiously, even if it is a delusion, the phenomenological character of that supposed event still remains as the ultimate source of the evidence for its sensible existence when we do not distinguish between data and perception.

Second, there are perceptions which, I am arguing, are more than just recorded sense observations of the things of the world. They are interpretations made upon those things, and here delusions are as powerful as adequate interpretations, and not overthrown simply by referring back to the sense data as evidence of the delusion or the misinterpretation. Finally, there are conceptual systems from which the interpretations are deduced, and which give them the forms they come to have. These concepts, when shaped into explanatory systems, are our "Root Metaphors."

Thus, we have a fairly clear, if perhaps oversimplified, sequence and relationship of the thinking act. Upon the data of experience, and from the concepts which serve as both the materials, the rules, and the contexts of thinking, we develop perceptions of the world in its particularities. Thus, the continuing question of what knowledge we can be absolutely certain about proves more thorny than ever, not because the objects of the specific knowledges which seem always to elude us in change or in ambiguity, but because we need constantly to distinguish and to test the defensibility of the elements which enter into the development of knowledge. Both percept and concept need to be attended to with even greater diligence. The Cartesian argument that the stick in the water deceives him by appearing to be bent is, as sense data, simply not the case. It is a misstatement. In terms of light refraction to the eye, the stick is bent. All eyes which observe this can see the bend. It is only later, when a concept of uniformity and continuity in nature takes solid hold of us, that we begin to ponder over what the eyes have seen, and we begin to perceive that the stick, as sensed, is a deception which elements of nature are playing on us. It is the concept which demands analytical scrutiny.

This problem, arising out of the failure to distinguish sensing from perceiving from conceiving, has plagued the problem of knowledge (and its use) for a great many centuries. The resolutions offered make a curious yet fascinating history of nature's explorers. For, in every such case, some set of data is selected by means of some metaphor, and offered as corroboration that this

one is the true one. The terms of the metaphor are hypostatized into actual instruments for perceiving the world, and then the original data summoned as proof that the metaphor is more than just a metaphor, that it is the reality itself. The gravest dilemma created here is that in the absence of distinctions, the delusions which appear are to be traced to the fact that what we pore over are models of some perception, not models of the data itself, or of the data, unadorned. We come thus to equate a model of perception with the data, and are thus unprepared for datal change.

For example, the Scholastic hypostasis of God as pure act, as the maker and sustainer of all things that are or ever could be, makes it possible to claim that the very data of reality is vindication of this hypostatic vision of God. But what we call data are our metaphor-laden models of perceptions of data, and thus we claim as logically proven what demands to be tested in experience. But the effort is clear. The relationship between the things of the world, the concepts by means of which we approach those things, and the perceptions of the character and the interpretations of those things which result, is the source of our knowledge of the world of things and the world of ideas.

There is no place here to dispute this particular (scholastic) metaphor. What is germane to us is the role which the metaphor plays in determining what we see. It sustains, indeed, determines the act of constructing from a particular, or range of particulars a universal form which corroborates the metaphor, as a mirror corroborates the face. The metaphor has been the basis for selecting,

interpreting and explaining the data before us.

For the Behaviorists, the computer illustration, if it is not found too facile and entirely lacking in the subtleties of actuality, shows much the same process at work. The evidence of the senses, now appearing to the sensing mechanisms of the instruments, is enlisted to give warrant to the thesis that man is a machine, and that the most complex of machines gives clearer and clearer insight into the ways in which man organizes his own powers in the face of the data, to perceive the world "as it truly is." The Deweyan approach falls squarely within this history, differing from all of the others only in the basic metaphor, that of social evolution and continuity from which he has constructed his resolution. And each way attempts to give a fair account of the data encountered, and the role which the data plays in the ultimate construction of the concepts, the universal "truths," which serve as the means of the actual perception of that data-filled world.

That perceptible world, organized symbolically into "purposive activities," by a given set of concepts which make possible those organizations and the observable sequential behaviors, are metaphors made tangible. What began as a metaphor, as an idea of possibilities of things drawn to some universal status, has become determinate and testable behavior as machine, as man, as nature itself. With the metaphor made so tangible, and its paradigm activity so effective, small wonder that we eagerly talk about machines which think, machines which understand, machines which evaluate their own outcomes. Do away with distinctions between theory, theoretical models,

VI

Education and the Use of Knowledge

Where have we reached in this analysis? Probably to the rather depressing conclusion that life itself runs constantly beyond the completely effective use of the knowledge we can command, or create. For knowledge is the means of coming at life itself, to organize, to account for it, to occupy it fully. Knowledge is the means, but thinking is the process, the act, by which this is accomplished, even while we remain aware that life extends beyond our most remarkable achievements of control over that life. For thinking is the act of developing, by means of metaphors constructed, the paradigms of activity which enables us to comprehend the lives we live, in the world we inhabit. Every discipline which man creates is a special manifestation of his thinking acts, and the knowledge which issues out of every discipline adds to the reservoir of models and metaphors which can be used for still further explorations and explanations of newer worlds which swim into view.

But we have also reached some fundamental distinctions which give hope to those who have otherwise given up because the idea of encompassing all the world in its ultimate development is seen to be preposterous. One of these is the distinction between knowledge and information, a distinction which resides in the presented structure

of each.* Thus, I have argued, devoid of its paradigmatic character, what appears to be knowledge is, in fact, simply information, or detached conclusions of logical operations of symbol manipulations. These become mountainous as time goes on and, beginning as a promise of available pieces for the ready solution of present problems, become themselves more puzzling than the puzzles they are invoked to resolve, by their very volume, and the fact of their emptiness of directions for use. The continuing disgorging of information from so many sources, of research, of mechanical means, of record-making systems, of improved systems of storage, ultimately dismay those who come to learn how to cope with the world which they are in the midst of. So they flee from the very system which has promised to teach them what they are expected to know, or required to know, or are supposedly well advised to know. Information in its growing mountainous volume has closed the world down altogether, and, by equation, the knowledge which is basic to thinking, to

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*This matter of the structure of knowledge, as compared to the structure of information, is a matter of great logical and epistemological complexity. Briefly, underlying the analysis I have made here: knowledge, as paradigmatic, is held as a belief because the concepts contained within it include evidential statements which are intended to support the warrantability of the concept. Such statements will include, as I have shown, primitive, or undefined terms, which are determinable as metaphors. On the other hand, information, even though it may contain such metaphoric premises, is treated as requiring no further evidence to support its usefulness. The only question here is of its "fit," or applicability to the puzzle before us. Thus, information statements contain nothing but absolute terms whose meanings are unalterable. They either fit the puzzle or they do not. In knowledge statements the primitive terms stand forth as requiring further epistemological evaluation.

(Cf. esp. Peter Winch, The Idea of a Social Science, Routledge, Kegan-Paul, 1958. Ch. 2.2.)

individual judgment-making is reduced to academic time-wasting. What a curious inversion we have here.

Thinking, I have attempted to show, is a symbol-manipulating act, and is only indirectly concerned with the world represented by those symbols. It is directly concerned with the systematic concepts which can be applied to the world and its particularities, giving meaning, sequence, inferential force and direction to the events of that world. In this, the difference between information and knowledge is found in the fact that in the former, experience itself is absorbed into and thus becomes the symbols which we manipulate, while in the latter, the symbols are conscientiously held as metaphors, symbols of events beyond themselves.

This only reinforces the importance of the distinctions made between data, perception and conceptual systems, recognition of which reduces the danger of treating the symbols, not as surrogate worlds, but as the world itself. Beyond this, we find ourselves sensitized to the role which our metaphors play in the thinking we do, in the organizing of the knowledge of one set of experiences to be shaped into instrumentalities for later experiences arising.

Even the very simplest kind of a statement which issues from this act, that, for example, fruit falls from trees, depends upon the sentence into which we can cast the perceptions; the syntax which is the structure of that sentence; the classifying systems which distinguish fruits from other events in nature; the systems of measurement which, at the simplest level, distinguish falling from clinging; to the more complex modes which distinguish rates

perceptions and data and we are free to talk about machines which can do whatever it is that man can order them to do, or which man does not order them to do. And when we are troubled that a machine does not understand what it is doing, that it cannot correct its errors (the gaps between what was intended and what was produced) and we seek rectifications, we turn to examining the machine itself in order to discover the absence of these elements in some program which would have to be present so that the behavior of the machine (or man, or nature) would be computed more adequately. That human beings are found to be programmatically inept is a simple truism within a given linguistic system. But the truism only increases the strength of the claim which has been established, of the identity of similarity between man and machines.

But within our distinctions the classifying system which we employ is conceptual in nature, a postulated, operating paradigm, by means of which we identify membership of events by suggesting a relationship between a given event and the paradigm which is construed to be the model for determining what shall be considered family resemblances among the events being considered. Only then can we see that the computer is itself a paradigm of knowledge whose operation is sorting and classifying according to postulated rules. When the computer is construed, or identified, as a thinking machine because its operations are defined as exemplary of man's powers to find and use information, we have a curious tautology, one which results from an undetected metaphor at work. Again, the metaphor now treated as a description of the state of affairs, deceives us by definition.

of speed of fall in the most refined degree; and to the complex problem of the structure and behavior of resistences.

What we come to know, then, derives from a paradigm for performing certain acts, overt or conceptual, and the attendant consequences of the employment of that paradigm. It is in this sense that I say that knowledge is itself paradigmatic in its structure.

But this raises a number of very critical issues. It suggests that I am saying that there is no knowledge which is simply information. And indeed, I am suggesting this, and offering a logical ground for Whitehead's classic observation that a merely well-informed man is the greatest bore on earth.

It also seems to suggest that ultimately all knowledge bespeaks man's experiences, all his experiences, physical and mental. For we can, obviously, have a knowledge of theory, and a knowledge of the rules for theorizing. What I am pointing to here, however, is a knowledge of theory, that is, of a theory, in so far as such knowledge is neither more information nor so abstract that it has no conceivable application to the world of human experiences. (In this sense, for example, to say "I know that my Redeemer liveth" may be a dramatic pronouncement, but in so far as some of its terms must forever remain undefined as part of its intention, it is epistomologically meaningless.) Thus, theoretical knowledge which has a solid claim is intended as an assertion about the paradigmatic grounds and the logical consequences, as well as the principles of employability, of a given explanatory concept about some aspect of possible or actual human experience which awaits some tangible illustration or vindication.

I accept the view that we cannot have knowledge of what is not true, of what is not the case. But when we take in what is true, we are, I argue, taking in a good deal more that just that it is the case. We are taking in the whole context of conceptual, paradigmatic frames within whatever is held to be true is in fact true. Moreover, if we cannot know what is not true, neither can we know that anything is true in advance of knowing it. (To accept the authority, even of the most careful of scholars, is to be in possession of some information, and all too frequently information that cannot become knowledge because it is not demonstrable as being the case.) Thus, we discover the truth in the act of attaining to knowledge, and that, in turn, re-emphasizes the paradigmatic dimensions of the whole process of this quest for knowledge.

The act of knowing can only be historically certain. That is, it was the case at such and such a time, within the strictures of the uses of such and such paradigms, within such and such a metaphor, that the following was known, and indeed was knowable. The applicability of that knowledge for any future situation, or any later case, becomes once again, a matter not only of employing the paradigm in a new encounter, but also of testing that paradigm in its metaphoric context upon the new matters under inquiry.*

These are all of the problems which I shall identify at the moment. I am pretty sure, however, that others will be offered, whose resolution I cannot even begin to anticipate.

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*It is interesting to observe that the decay of truth begins with the decay of its basic metaphor, and its abandonment at last with the abandonment altogether of this metaphor.

As for the metaphors, it is by means of these that we transform the structures of what is known in one setting, in one world, to usable structures for the development of the paradigms of inquiry in some other realm of experience.

Which brings me, at the last, to the role of education in the uses of knowledge. I have already argued the matter of the distinction between the schools which are concerned to produce puzzle-solvers as compared with the educational concern with the development of problem-solving intelligence. The latter, only, fits within our definitions of the thinking act. We are all familiar with the school programs which introduce science to children as puzzle-solving processes, only to discover that the residuals of such instructions are invariably either a turning away from science altogether, the development of technicians, or what Dewey has called "sharps" in the taking of examinations at the end of a given sequence.

But it must be evident that the greatest deterrent to education in the modern world is the very status which our hardened metaphors have taken on, and the rigidity with which the paradigmatic character of knowledge has been treated. In the one case, merely to identify the metaphor-become-myth is to challenge a body of faiths in a way that is bound to challenge also the convictions by which men live their lives. So an educational process whose concern with knowledge is to use <u>it</u>, to examine it, to explore into it, to search out the foundations and its rules for operation with the intention of continuing to test their warrant in new contexts, is bound to raise the most vigorous resistance. Nor is it inertia alone which is at the base of this resistance. More likely, it is the almost religious

fervor with which our myths are held, as being surely and beyond reproach, the instruments for the resolution of all of our problems that drives us to look for information and not for knowledge which might be used by being built again at the time it is needed.

And to see that all knowledge is paradigmatic, comprised of systematic rules for exploring both the world and the already concluded experiences of that world is to see, too, that fixity of knowledge makes a paragon out of a paradigm. The one is to be adored, the other is to be reconstructed at every required opportunity. But such an education demands a vigor of mind and a love of the opportunity to alter and modify that is sadly lacking in our world today, if it ever existed to any great degree.

But of course, the quest for a "practical" program is real and legitimate, however difficult. Yet as in no other undertaking, tender-mindedness and the desire to enable all of us always to succeed victimizes education by appeals to simplicity. All our experiences about the absence of a royal road seems only to heighten the desire to find that royal road, to make learning clear and simple, and the uses of the proper information at the proper time immediate, exact, and triumphant.

I have been at pains to show the traits of thinking as an act, and knowing as the outcome of that act. Such traits, however clearly described, should emphasize that simplicity is a dangerously misleading end. In the terms of this analysis we need, all of us in education, to become--as we have begun to become--more and more methodists, more and more concerned with the structure of the paradigms available to us. We need curricula in schools which turn inward to

the models, the metaphors and paradigms which are the how of men's experiments and experiences. In mathematics we need to know how symbol-systems and their rules of operations actually operate so that we can construct newer operations to meet newer problems. In the social sciences we need to know the conceptual operations of the metaphors and the paradigms which we inherit, or which inherit us, and which become the principles of explanation, organization and interpretation of the events we encounter each day. In the natural sciences we need to know the methodological operations of the concepts we have inherited, so we can transform information into knowledge at the end of each new investigation. In the arts we need to learn the metaphors of linguistics or symbolic expressions which are available to us in order to use them satisfactorily, or to construct against these yet newer metaphors of expression.

In short, we require an education for conceptual competence, for the development and employment of models of inquiry, into which can be fed the data (information) available, until it becomes, at the other end of our individual explorations, the knowledge which becomes the paradigm for still later investigations.[12]

In this sense, then, we have a choice--of learning the evidence offered to support the use of a particular model which prevails, or we can learn the structure and the grounds of that model (along with the evidence offered to corroborate the worthiness of its use), and with it, learn how to construct alternative models by means of which the noted evidence suddenly is found to have new meaning, new explanatory force, new and different interpretations.[13] The former of these is the road to simplicity. Learn the basic evidence, and

don't concern yourself with the model as such, for it is claimed to be self-evident. The latter is not the road to simplicity, but the road to a different kind of competence, the competence of conceptual constructions, which brings the data into a new realm of flexibility of meaningfulness.

If we remember that every discipline is a model-making, a paradigm-making activity, and the data of experience that to which we apply our paradigms, then education ought to be directed toward developing increasing competence in the construction and uses of those paradigms. But such an educational undertaking is not accomplished in a short time. Certainly it is not accomplished in the time it takes a child to learn to use the information which comes daily streaming out in his direction. It takes as much time as it takes any of us to develop a grasp of all the concepts and the symbol systems needed, for example, to read a cardiogram and interpret it, and then to discover that what the cardiogram says about a heart's functioning may well be limited to the structures of the cardiogram instrument itself, and that the heart may yet be read in greater subtleties.

NOTES AND REFERENCES

[1]I. Scheffler, Language of Education (CC Thomas, 1960); Conditions of Knowledge (Scott-Foresman, 1965). Cf. also Richard Peters, The Concept of Education, Chapter 1, (Routledge-Kegan-Paul, 1967).

[2]T. S. Kuhn, "Logic of Discovery or Psychology of Research," in Criticism and the Growth of Knowledge ed. by Lakatos & Musgrace (London: Cambridge University Press, 1970). This important distinction between problem and puzzle derives from Kuhn's brilliant analysis. The use to which I put it, however, is not his problem, but mine.

[3]Colin Turbayne's Myth of Metaphor (University of South Carolina Press, 1972), is the richest source I know for an analysis of metaphors.

[4]The most luminous account of the structure and role of paradigm is to be found in Kuhn's Structure of Scientific Revolutions (University of Chicago, 1962). See also Marc Belth, New World of Education (Allyn and Bacon, 1970).

[5]G. Ryle, Concept of Mind (Barnes & Noble, 1960).

[6]B. Russel, Problems of Philosophy (Oxford Press, 1946).

[7]M. Polanyi, Personal Knowledge (Harper, 1962).

[8]Cf. esp. P. Achinstein, Concepts of Science (Johns Hopkins Press, 1968). See also M. Belth, Education as a Discipline (Allyn & Bacon, 1965); and N. R. Hanson, Patterns of Discovery (Cambridge University Press, 1958).

[9]On this, and the later distinctions between data and perception, see C. W. K. Mundle, Perception: Facts and Theories (Oxford Press, 1971).

[10]Cf. A. M. Turing, "Computing Machinery and Intelligence" in Computers and Thought ed. by Feigenbaum and Feldman (New York: McGraw-Hill Co., 1963).

[11]On root metaphors, cf. Stephen Pepper, World Hypotheses (University of California Press, 1961).

[12]At Queens College (City University of New York), we have begun a program which seeks to develop the methodological character of model-constructing and model-using in each of the standard disciplines, until we can learn to construct newer models of inquiry, and thus, newer disciplines for the sorting of human experiences. We have called it a program in the Application and Development of Educational Models (ADEM). What men have achieved in the various disciplines of science, of history, of mathematics, of the humanities, become for us reservoirs of competent systems for sorting out the experiences of mankind, and ascribing meaning, direction and explanation to them. The anthropologist, for example, who argues for the aggressive inheritance of man, and, in its terms, explains the record of his behaviors, becomes but one among a range of possible models for explaining that record, and its limits. And just to so identify him makes the quest for and developing competence in alternative models possible and desirable.

[13]Much has been written in recent times on the nature and function of models, some fairly simple, some very complex. I note here several of importance:

R. Harre, The Principles of Scientific Thinking (London: Macmillan, 1970), esp. Chs. 1-3.

M. Hesse, Models and Analogies in Science (University of Notre Dame Press 1966). The whole essay is valuable, but the chapter on metaphor (pp. 157ff.) especially pertinent to us.

M. Black, Models and Metaphors (Cornell University Press, 1962), esp. Chs. III and XII.

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Research Memorandum #14:

"The Implications of Technics in Education"

Originator: Elizabeth S. Conley, Graduate Research Assistant

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Public Inquiries

Twentieth century American society has come to expect science and technology to provide the means for solving some of our deepest problems. Adults and even children have witnessed in their own lifetime marvels that previously seemed unimaginable, much less possible. Radio, television, electric appliances, the pill hit the home and family life at its heart. The car and with it superhighways have drastically changed our way of living and even our concepts of space and time. Many of us grew up watching Buck Rogers and Flash Gordon conquering space in television serials. Since then, we have seen the real thing and on the same medium. The moon flight did not come as a surprise; it was expected. Just as we expect that a cure for cancer will be found someday--soon. A strange example of this kind of faith can be found in cryogenics, which is a process of freezing bodies of persons who have a disease which currently has no cure. The assumption is that when the cure is invented, the body will be thawed, the remedy applied and resuscitation is presumed to occur.

We have the feeling that whatever problem we want to solve, we can solve it, given the money, personnel and dedication. Because we have "solved" so many problems in this century--TB, polio, ways of instantaneous mass communication, high yields in agriculture, more products with less labor less raw materials--it seems feasible that we could "solve" many of the social ills that trouble us. Poverty, disease, ignorance should also be "solvable" in much the same way that making the atom bomb or getting a man on the moon were.

However, with a society as complex as our own in which interdependence becomes an increasing factor in change, a shift in one area affects all others. To concentrate on the educational enterprise and some of the technologies that might be useful to this enterprise brings up questions that are relevant to many other areas. Frequently the kinds of questions that have to be asked are not just "how to do it" questions, but "why" and "what for" kinds of questions. Although the answers to such questions are not within the scope of this memorandum, the questions themselves are a necessary prelude to any discussion of techincs and education in this country. That is, we have to name the problems "well" before we can try to solve them.

Should schooling as currently designed--often in imitation of the industrial model of specialization, division, standardization--be continued in this society? Are there more efficient ways to accomplish the purposes of education in this society outside of the school system? Should the aims and goals of education be reevaluated and set out in more specific terms? What kinds of controls do we wish to impose on the education of the young? What are some of the skills and competencies that will be needed twenty or thirty years from now? Because we have certain technologies available to us, does that necessarily constitute a reason for using them?

Currently the aims of the educational enterprise in this country seem threefold: providing the skills necessary to run the society; socialization into the value scheme of the

society; and (perhaps) helping to develop inquiring minds. If it is true (and I think it is not) that we can accurately predict the skills that will be needed in the future and the kinds of social patterns that will be developed, then we can make very efficient use of the technologies we have currently available in education. Films, television, programmed instruction, audio tapes and radios have proven their viability as learning devices when clear-cut objectives are defined. However, this view presupposes a one-way transmission of knowledge in which what is to be known is pre-set and pre-determined. If this is the case, then the problem of education can be boiled down to one of engineering. If we know the what, then the how is not too difficult.

The obvious question about using any technology in education is the relative effectiveness of that medium in terms of the desired educational objectives. Interestingly enough, in education, there is little experimental evidence to point the way for the making of these instructional decisions.[1] There seem to be several explanations for this dilemma. One is that educational objectives are not as clearly defined as a classroom engineer might wish. And this is a basic problem, not only for education as a whole, but also for the kinds of uses to which we may wish to put educational technology. Second, much of the research done in the area of educational technology does not continue for a long enough period to refine the use of any particular technic. When one considers the staggering cost of adding

just one dollar per student to the educational system, it would seem sensible to be fairly certain that a new technic will actually improve the instructional situation.

I will present some of the research that has been done in the area of film, television, radio, and the computer in education; then indicate some of the areas that have been left unexplored that might be useful in the educational enterprise. I limit myself to these technics as they are somewhat new to the educational system and may be the spur to greater changes in that system. Following will be some practical considerations about the nature of electronic technology when used in the classroom, and some conclusions.

Much of the impetus behind using film for formal education stemmed from the results of using training films by the army during World War II. It was then found that films could be effective teaching devices and so the film became a legitimate tool for educational purposes.

The following generalizations about film in the classroom are based on: Summary of 65 Instructional Research Reports,[2] a report of studies conducted at Penn State University between 1947-1956; Charles Hoban's report "The Usable Residue of Educational Film Research";[3] Paul Wend and Gordon Butts' summary of film research between 1956-1962;[4] and Greenhill, Reid and MacLennan's Research in Instructional Television and Film, which is a review of all film research between 1950-1967.[5]

-Good films can be used as the sole means for teaching some kinds of factual materials and performance skills.

-Increased learning will occur if viewers are told "firmly" what they are expected to learn and that they will be tested on this.

-Learning increases with the combination of pre and post testing, repeated showing of the film, introduction to the film and other related activities.

-One showing of a film teaching a complex skill is insufficient.

-Films with the purpose of informing can command attention up to one hour.

-It is important for students to know terms used in a film before viewing.

-The sound track on a film carries important information.

-Films can promote positive attitudes toward a subject.

-The massed use of films may effect a poor attitude toward them.

-Films with built-in audience participation, redundancy and repetition can increase learning.

-Note taking during the film showing interferes with learning.

-Learning with films improves with practice.

What the research seems to boil down to is that students can learn from films but can even learn "better" if the film is surrounded by the kinds of activity that are traditionally used in the classroom: preview, review, repetition. The film alone is just another input. What the students do with it depends a great deal on their own initiative and that of the teacher. What is striking about the research is the emphasis on what the students

are supposed to "get" from films.

What the research doesn't say is what more did the students learn from film as opposed to traditional teaching. What particular subjects would profit most from learning from film rather than some other technic? Are films a good vehicle for expanding vision, for giving experiential knowledge about some concept, and is this a desired educational objective? What about open-ended evaluations that describe rather than prescribe learning objectives?

Note that the first point on the film research qualifies learning from films with the term "good" films. Without going into specifications about what makes a film good or not it is important to note that it won't do anyone any good at all to use film or any other medium for that matter without taking into account the characteristics of that medium and using these optimally for educating. Film has the capability to be much more than a talking head. By its very nature as a moving, visual medium it cries out for movement, for strong visuals. It seems absurd to have a film from which most of the data is carried by the sound track. Film is a visual medium and much of the data should be visual, otherwise why not use sound alone? It's much less expensive. Unfortunately, this is not true of many "educational" films. The conventions of the classroom have carried over into the film rather than the other way around. The result is that the film experience is not much different from that of a lecturer, without the added benefit of audience feedback of some kind.

Film research deals mainly with "educational" films rather than commercial types. However, there is a big market right now for commercial films for entertainment, guidance, literature and for film classes as such. The film as a subject worthy in itself for study is beginning to make inroads into the educational world so that film study is being legitimated as as much a part of the curriculum as English literature. While I am convinced of the value of film as a learning device, it may well be that putting film into a school environment may so restructure the experience as to destroy much of its delight.

One of the sad lacks in the study of film in the classroom is that of student made films. Although this is a growing movement on all levels of education, there is little study of its effect on learning. Visual composition would seem to be as important a skill in an electronic world as literary composition, yet filmmaking is still something of an experiment in the school system. This area seems to be a ripe one for further exploration. As the use of coexpressive media in all probability will expand, the need for good filmmakers will also grow. I have seen the efficacy of using this approach to self-expression especially with Spanish speaking students and other students who were convinced they were unable to write.

Eight millimeter film and film loops in the schools are rather recent developments. Their chief advantage lies in the low cost of film and equipment. Film loops, especially single concept film loops are beginning to be widely used in schools. Because the film is inexpensive and easily manipulated, film loops have

become useful for individual study. Like 16mm film and television, however, the major problem with using 8mm film lies in the software itself. While 8mm film and film loops are inexpensive and very adaptable, they are only as useful as the material or program they carry.

Television is almost 25 years old. In this comparatively short span of time the TV set has become an ubiquitous part of the American scene. From its inception, television has been seen by educators as a tool that could change the shape of the educational process. Many claims have been made for it. Few have been realized. The Ford Foundation has spent close to a billion dollars underwriting projects for instructional television. Whole school systems have been taught by television. The Corporation for Public Broadcasting was recently founded after a report from the Carnegie Foundation recommending such a step, with the result that more public money has been allotted to educational television than ever before. Universities, colleges, high schools and even elementary schools may have elaborate closed circuit television systems. States have their own educational channels and produce educational programs complete with teacher manuals, visits to the schools and some feedback. Yet, in spite of this outlay of money, vast quantities of research and a great deal of drum beating, all television equipment could be ripped away from the schools without causing much of a ripple.[6] (Try doing that with blackboards or P.A. systems.) Now why is this?

Godwin Chu and Wilbur Schramm's study for the National Association of Educational Broadcasters, "Learning from TV: What the Research Says," is a compilation of the results of 421 separate comparisons of television teaching with conventional teaching.[7] The comparisons in 308 of the studies showed no significant difference between television and conventional teaching. Sixty-three showed television to be better and 50 showed conventional teaching better. Studies have varied different factors--black and white versus color, teachers along with the television program versus no teachers, different subject matters, and so on. Yet there did not seem to be much of a difference in the final results. The tests did show that television was more easily used for primary and secondary school students than for college students. What the tests seem to indicate is that television can be used efficiently to teach any subject matter where one-way communication will contribute to learning. Here again the question of what a school is for may be a deciding factor in the use of instructional television. If it is to impart some predetermined "knowledge," then perhaps much more research should go into this area.

As it has worked out, television has in no way become a replacement for the teacher. Any schemes for using the electronic tube as a surrogate teacher have long died out and with them the savings that using television might have brought to the system. Television will not save money for the schools if it is used in the classroom situation. It might save money if the students stayed at home for their instruction. This might be an area to probe further.

Why couldn't students restrict school experiences solely to interaction with their teachers and each other and acquire the information they need from the television?

Educators are fond of quoting statistics to the effect that children, by the time they reach school age, have already spent more time in front of the TV than they will spend in the classroom. Even adults spend far more time with the television than they do in almost any other leisure time pursuit. This medium is a major part of the American style of life and as such should be taken into account by educators. It is not enough, however, to place the television set into the classroom and broadcast classroom activities of the usual variety over it. The medium does not work that way. Neither does it suffice to decide to use television simply because it is there. How it has changed the environment and perhaps even the way people use their senses has to be taken into account for using this or any other technic.

Although the purpose of commercial television seems to be that of "entertainment," it is impossible to say what it is that the viewer gets out of any program. Perhaps some of the most effective education is already occurring through "entertainment" shows. While violence in television is the subject of many articles and studies (the most recent a prestigious one from the Surgeon General stating that television violence may have an affect on children already prone to violence,) not much attention is given to the other side of the coin.

Policemen in New York noted that youngsters being arrested in the past few years have a much more informed sense of their legal rights than ever before. This they attribute to television cop shows. The whole legal system and many of the traditional American rights have been the themes on such shows as Perry Mason, Judd for the Defense and The Bold Ones. Marcus Welby, which has been the number one show on the Nielsen ratings for several years now, and Medical Center, offer medical data every week. These are just two examples of the kinds of data that occur regularly on "entertainment" shows in television. Like the Renaissance scholars who objected to the printing press because it would vulgarize learning and language, the educational community tends to downgrade commercial television as trivial and vulgar. (Usually with the added comment, "Of course, I never watch it." Maybe they should.)

As is the case with film, television does not have to be a one-way medium. Video tape recorders and television cameras are simple to operate and are becoming less expensive. Tapes are reusable. After the initial investment, taping equipment and cameras are less expensive than film to operate and have the added quality of immediacy. Perhaps video composition should also be part of the curriculum. Students have learned the basic conventions of this medium in the long hours spent before the set. They know what "works" and what doesn't. As students experiment with video they may have great impact on changing those conventions creatively. If the future brings more access to community

television through cable systems, it might be as important for students to know how to compose for video as to write. Two cable stations were made available in New York City last year for community groups or individuals who wanted to present some issue for public debate. After five months only a small fraction of the available time had been used. Part of the reason is that television has been something reserved for the "experts," much like reading and writing before the use of print. Even more than film, because of its immediacy, video tape offers a great expansion in the area of self expression. Instead of viewing television primarily as a medium for disseminating information, it could be utilized as a means for students to communicate their own perceptions of how the world is and what is important to them.

Educational radio is a non-profit enterprise ordinarily operated by educational institutions such as colleges and universities. Since 1938 when only one station was operating as an educational medium, educational radio has grown to over 450 in 1970. Two-thirds of this growth occurred in the last ten years. Part of this is due to government regulations reserving part of the spectrum for educational purposes.

Like studies on television and film, the research on educational radio points out that learning can and does take place through the use of radio alone. This is especially true when comparing a lecture-type class with classes learning the same material through radio. Students who learn language and music appreciation seem to do even better than other students taught by a

teacher alone.[8] Another area that seems to work well using radio is that of creativity. Teachers have found that teaching creativity in art classes is more effective through radio than television because it spurs the use of the imagination rather than encouraging the students to more or less copy models presented visually. Learning to listen is another important skill that has been successfully taught through radio.

Some universities are having success in using radio for keeping professionals such as doctors, lawyers, and engineers up to date with advances in their fields. With the addition of multiplexing and two-way receivers there can be interchange between the listeners and originators of the program.[9]

In a similar manner, station WDTR in Detroit broadcasts city-wide teachers' meetings using telephone lines for feedback. Other cities have used educational stations for instructing teachers in innovations such as the "New Math."

Marshall McLuhan says that radio is a "hot active" medium as opposed to television, which he labels "cool passive." It is, perhaps, in this aspect that radio can capitalize. Sound seems to have the capacity to emotionally involve the listener. And in an age when visual images are so pervasive, radio may be a unique way to help stimulate the creative imagination.

There is a great weakness in any research about the nature of radio's audience, however. This seems to stem from a lack of conviction about the necessity of such research, the lure of television as a more fruitful area for study and budget.

(Over half of the educational radio stations operate with a budget of $20,000 or less.)

Computer assisted instruction (CAI) is still in its infancy. The greatest problem with it now is the kind of programming to put into it. At present, most of the instruction going on could be adequately dealt with in a programmed instruction textbook or much simpler teaching machine.[10] This is not to downgrade its possibilities, however. If we are willing to spend the money on it, the computer could offer the ultimate in individualized learning. The important point to consider here is that the computer is only as good as what goes into it. Programmers have a saying, "GIGO--garbage in, garbage out." Like film and television, if the computer is going to be used only in terms of an aid to traditional teaching, as only a sophisticated teaching machine, one might as well ignore it for the school. It is much too costly and will be little improvement over the existing system.

Some Practical Considerations

Any piece of equipment that is exceedingly difficult to operate will not be used in the classroom. A teacher who has from 10 to 40 students on hand does not want to fool around with a machine for a long period of time. The easier a piece of equipment is to operate, the better it will function in the classroom. Availability is another key factor in the use of technics. If showing a film involves lugging a projector around the building, or

setting up black-out curtains every time, chances are the films will be few and far between. Add this to the fact that films often hav be ordered far in advance by a teacher who isn't sure where her class will be. Machines have to be durable if they are to be used in school. One of the major frustrations of teachers is trying to use equipment that develops some technical difficulty at exactly the moment he counted on using it for class. Take something as simple (?) as a slide projector, carousel type. These are intended to be pre-set so that a whole program can be presented with ease. Then when the teacher starts the program, the slides jam, or the cue doesn't activate the machine. Take 5 or 10 minutes (if you're lucky) and fix it, your program has been interrupted, attention lost and the class bell rings before the program is completed. If a piece of equipment is intended for student use it must be even more durable because of the larger number of people handling it. Probably the only way to assure this kind of durability in equipment is to protect the schools by laws of minimum standards. When video tape and computers become part of the school scheme, their designers will have to consider the rough usage they will be subject to and build in protections for the machine so that the works won't be literally and figuratively gummed up.

This memorandum has dealt mainly with some of the findings about the use of non-print media in the schools. I chose this approach to the question of the effects and implications of technics on education as I believe that the electronic media are of such a different quality as a means of communication that

eventually they will force changes in our thinking about the educational enterprise as a whole. Innis points out in The Bias of Communication that the communication technics used in a society do much to shape the way that society organizes itself.[11] He theorizes that when a culture changes from one type of communication technic to another, the interface between those technics stimulates creativity and energy so that the culture as a whole flourishes. It may well be that our society is in just such a period as the communication bias interfaces between print and electronic media.

Schools have spent much of their time dealing with literacy--literacy in the sense of teaching students to read and write. This has been necessary to fit people into an industrialized society. But what schools have frequently done is to pattern the school very much after the factory or assembly system. If we can see what in the past has been the interaction between the occupational needs of the society and the schooling devised in the society then it may give us some indications about the shape that we should devise for schools now. In this the communication technologies we have developed can play a crucial role.

Broadcast media have the capacity to play to large audiences, to dramatize, to be immediate. They seem capable of disseminating information necessary for the general information of the public. Thus this function is not really necessary any longer for the schools. What the school as such might want to focus on in using electronic media is the capacity of that medium to be

diversified and individualized, so that the school would focus not just on print literacy but oral and visual literacy as well. The school can be viewed not as a disseminator of knowledge so much as a place where students and teachers can be given opportunities to "make sense" out of the already overwhelming flow of data that they are exposed to outside the school. The school can be a place where the individual is assisted in producing his own unique bodies of knowledge and sharing them with others.

What seems at stake here is not to use electronic media as disseminators of knowledge as much as helps for individuals making inquiries and following through on those inquiries.

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