DOCUMENT RESUME

ED 055 022 SP 004 786

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TITLE A Review of Studies on the General Problem of Knowledge Production and Utilization.

PUB DATE [70]
NOTE 70p.

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Feedback; Information Dissemination; *Information Retrieval; *Information Science; *Information Utilization; Research Criteria; *Research Methodology; Research Needs; *Research Utilization

ABSTRACT

The growing complexity of society has resulted in increased attention to the problem of knowledge production and utilization. This review of the scholarship pertaining to this subject traces the topic in its most general sense. Three fields of interest have received attention from researchers: 1) the relation of research to practice; 2) the nature of knowledge production; and 3) the nature of knowledge utilization. Little information is available about the first. Claims to validity for specific conceptions may differ between the researchers and the practitioners, and if research is to have an impact on practice, some disciplined study of the task and needs of the practitioner must be undertaken. In the field of knowledge production, researchers have asked a wide variety of questions and applied various methods of study in education, sociology, and science. This research literature must stand the tests of critical review and organized synthesis to become valid knowledge in the general sense. The utilization of knowledge needs to be more fully understood if it is to be effective. Techniques for locating and retrieving information have been developed but have not been as successful as expected because they are not always related to the user's understanding and needs. A bibliography of 98 items is included. (MBM)

A REVIEW OF STUDIES ON THE GENERAL PROBLEM OF KNOWLEDGE PRODUCTION AND UTILIZATION*

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The general problem of knowledge production and utilization is one that has recently become the object of increased attention both in the realm of practical affairs and in the community of scholars. (Carter, 1968, p. 1) In the society at large, knowledge production and utilization has taken on greater significance because of the growing complexity of society and the accompanying increase in the number and difficulty of the decisions, both general and specialized, that must be made as a result of the development of the society in this direction. We now have what Daniel Bell

*This paper is a preliminary draft. It may not be quoted or cited without the author's permission. Readers are asked to communicate suggestions or corrections to the author.

calls a postindustrial society. Rather than being dependent upon the sweat of man's brow, as in a preindustrial society, or upon the energy-harnessing processes of machine production, as in the industrial society, a post-industrial society is organized around information and systems of knowledge that are necessary for use in guiding the society. (Bell, pp. 14-15) The basic social and economic arrangements of society are no longer simply the function of the necessity to survive or to produce goods and services. To a large extent, they can now be determined at the discretion of society to serve whatever purposes may seem best. These personal and social decision-making processes may function at a wide range of points in society and respond more fully to human wishes. Though free from some of the constraints of the preindustrial or the industrial ages, these processes are inevitably carried out with some risk. They

are clearly dependent upon the quality and character of the knowledge utilized in determining what should be done and in choosing to act accordingly. The society increasingly is being organized to bring to bear knowledge and information essential to the execution of these decision-making processes. It goes without saying that getting and using this information are among the most difficult tasks men attempt to perform, whether acting individually or collectively, as specialist, citizen, or representative champion of the general welfare. (Etzioni, pp. 174-177)*

Perhaps in view of the widespread recognition of this social situation, scholars, not to be outdone by others, have begun to respond with their usual skills of mind and will by engaging in disciplined examination of the

*For a discussion in a wider context, see Kahn, 1969.

problem of knowledge production and utilization.* The complexity of the phenomena is staggering, and the customary tools of research have not always seemed clearly appropriate to this sort of inquiry. Progress has been made, but slowly and on a jagged front, in the effort to understand and to guide KP&U toward its ultimate practical, social purposes.

This review of scholarship pertaining to the study of KP&U traces what is known about this topic in its most general sense. This frame of reference should be of value in interpreting the problem of KP&U in particular fields.**

Relation of Research to Practice

Within the range of phenomena encompassed by KP&U, three domains of interest have received considerable attention from researchers:

*Frequently hereafter referred to simply as KP&U.

**For an examination of the problem of KP&U in the field of curriculum which utilizes this general frame of reference, see Short, 1971.

1) the relation of research to practice,

2) the nature of knowledge production, and

3) the nature of knowledge utilization. The research to be reviewed will be organized around these categories.

The first of these, it may be said, has proved most resistant to formal investigation. The relation of research to practice, as a class of phenomena, apparently is so multi-dimensional and multifarious that little can be said about it in general. Guba admits that the researcher is now less cavalier about asserting the usefulness of research for practice than he once was. He states:

> "...it is clearer now that the potential contributions of research to practice are limited...we have also become aware that research is but one of a number of potential inputs into improvement activities; also worth consideration are practice, precedent, and expert advice and consultation. Moreover, economic, political, contextual, and other constraints must also be considered in detail if the proposed improvement is to have any chance of acceptance." (Guba, 1970, p. 27)

The assumption can no longer be made that if only the considerable knowledge that exists related to a given area of practice were to be applied, that practice would be immensely improved. The recognition of this error does not imply that knowledge is worthless nor that researchers should stop searching for valid generalizations. It only compels us to recognize the complexity of the relation between research and practice which formerly wa thought to be so self evident that it was scarcely given any serious thought.

The study reported by Guba is drawn from the field of education. However, in the wider world of practice, scientific knowledge has also had its status and value questioned from time to time, even in the so-called scientific era. Study of what could be done to reduce hostility to new knowledge and increase its acceptability among users has been undertaken by many scholars in the past and continues to

this day in the form of specialized psycho-sociological studies devoted to this question. (Havelock, 1969, pp. 4-1 to 4-30) But scholars have also sought to explain the more basic problem of how new knowledge replaces older knowledge in any human being. James Harvey Robinson, in his eloquent response in 1923 to the challenge of critics of the principle of biological evolution, mentioned the role that knowledge itself plays in its being accepted, whatever may be the predispositions of individuals confronted with it. He restates a conclusion attributed to Matthew Arnold which indicates that men do not change their minds as a result of logic and refutation, but as they learn more, the ground "gently shifts beneath them and they no longer look at things as they formerly did." (Robinson, p. 64) The same point is made by T. S. Kuhn in his treatment of "paradigm shift" in science. (Kuhn, pp. 91-134) This concept of Kuhn's, by the way,

is illustrated in the field of education in a study by J. W. Getzels. He notes that the changes in the operational paradigm held by practitioners of the human being or the learner, (e.g. from an exclusively stimulus-reducing organism to one that is a stimulus-seeking one as well) can be accounted for only by the long-range indirect contributions of theoretical research to the understanding of behavior. He infers from this and other examples that:

> "The significant influence of research comes not piecemeal--study by study, technique by technique, and practice by practice. Rather it comes cumulatively through altering the general conceptions...of the human being and of human behavior which serve as the context for educational practice." (Getzels, reported in National Center for Educational Research and Development, 1970, pp. 139-141)*

Thus, the status of the conceptions which functionally operate in practice depends in

*Similar studies of the impact of educational research on practice are summarized in National Center for Educational Research and Development, 1970, pp. 139-153.

part upon the form and validity attributed to that knowledge by users.* Sometimes what researchers expect to be an appropriate form for use in practice is not received that way by practitioners. (Havelock, 1969, pp. 4-29 to 4-30) Likewise, claims to validity for specific conceptions may differ between the researcher and the practitioner. (Havelock, 1969, pp. 8-38 to 8-39)** This practical dilemma in the relation of research and practice is a persisting one, but is not a wholely undesirable one. Mutual enlightenment of the parties involved may result. It has often been noted that researchers know very little about practice and that practitioners are little aware of the way the researcher comes to his conclusions. (Havelock, 1969, p. 2-33 to 2-34)

* The psychology of knowing has produced findings relevant to this problem. See works by Jerome S. Bruner for a review of research in this area: Toward a Theory of Instruction. New York: W. W. Norton, 1968, pp. 44-48, and On Knowing. New York: Atheneum, 1965. pp. 31-42 and 81-96.

** It may be that users are also sometimes skeptical of the epistemological base of some research they are asked to accept because they are better aware of the conditions under which knowledge can claim validity than are the researchers. See Machan, pp. 262 - 263.

If research is to have an impact on practice, some disciplined study of the tasks and needs of the practitioner must be undertaken. Lynd, in 1938, understood this truism. Speaking about the social sciences, he both hurled an indictment at his field and pointed to a raison d'être for it. He wrote:

> "...the social sciences have tended to emphasize data gathering rather than data needing to be gathered, normative theory rather than the full range of refractory phenomena, and to stress Knowledge and Order rather than the vast areas of the Unknown and Chaotic." (Lynd, p. 118)

He adds that to enter a discipline as a scholar is to enter a fenced off area of culture and to shrink away from "insistent reality" with all its unintelligibility. He sums up the unfortunate state of affairs by declaring:

> "... The failure of the social sciences to think through and to integrate their several responsibilities for the common problem of relating the analysis of parts to the analysis of the whole constitutes one of the major lags crippling their utility as human tools of knowledge." (Lynd, p. 15)

He lamented, as we still do in 1971, the growth of knowledge faster than it is being institutionalized into the habits of thought and action of people. His recommended response was to supplement, and in part replace, the several disciplines by a series of "problem-areas on which workers with all types of specialized training and technique would be cooperatively engaged." (Lynd, p. 166) He opted for a multi-disciplinary attack on problems which would result in knowledge of the "wholeness" of an area of practical reality.*

Robinson, thinking of the users of this knowledge, urged a course of action to advance the assimilation of new knowledge. Even today it has not become a widely adopted strategy though studies continue to show the validity of his argument. (Havelock, 1969, pp. 8-46

* "Few mechanisms for translation of social scientific understanding into societal benefit have been institutionalized so as to assure this process." (National Science Foundation, p. vii) "The professions are among the main social institutions through which social science knowledge can be translated into day-to-day practice." (NSF, p. 21)

to 8-51 and 9-36 to 9-41). Stressing that knowledge must be reordered and restated, put together in a new form that corresponds to the prevailing questions faced in practical affairs (ones that, like Lynd, he recognized do not come as neatly differentiated as in the various disciplines of inquiry), he called for "resynthesizing knowledge" to match phenomena experienced. (Robinson, pp. 63-96) This process would roughly correspond to the "translation" phases of the processes of development and diffusion of knowledge inaugurated in recent years.*

Assuming that professional people acquire through schooling some of the knowledge required for the conduct of their practice, Broudy and his colleagues have argued that

*The quality of information being made available to the educator through current USOE dissemination activities is questioned by Stake. "Perhaps we have not provided the information in a form he can use...it is not appropriately synthesized and accessible...perhaps the information should be pulverized and reconstituted as some form of experience for the experientially oriented intuitive educator." (Stake, pp. 6, 8)

the kind of knowledge most useful to the specialist or the professional is that which may be used "applicatively"--that is, to solve problems previously not confronted.* Such knowledge is relatively systematized and is derived from many disciplines. In stating that the problems of practice are not ordered in the same way as the basic or applied disciplines of knowledge, Broudy echoes an understanding of the relation of research and practice mentioned earlier by other scholars. (Broudy, pp. 61-71)

John Dewey's treatment of the matter under review here is set in the context of educational practice. (Dewey, pp. 14-21) He introduces the distinction between practice theory in teaching and the principles of the discipline of the psychology of learning. The former is

* The associative, replicative, and interpretive uses of knowledge are by no means irrelevant to the conduct of specialized or professional practice. (Broudy, pp. 43-60)

not derived directly from the latter, but rather, at least in part, from the body of practical experience.* An empirical sanction for practice is different than empirical validation of theories in the disciplines.

In general, it must be admitted that "little is known in a systematic way about the process of deriving recommendations for action from research findings." (Sieber, 1966, p. 352) This brief excursion through the general domain of scholarship on the relation of research to practice is sufficient to suggest the general difficulty scholars have had in building systematic knowledge about the general problem of KP&U when viewed from this perspective. While it is safe to say that the fruitfulness of this approach has not been great, it has nevertheless permitted some clearer understanding to be developed of the complexity of a real and per-

*See also Ernest R. Hilgard, "A Perspective on the Relationship Between Learning Theory and Educational Practices," pp. 402-415 in Hilgard, 1964.

vasive problem and has suggested avenues of perhaps more profitable research. Fundamentally it has had the merit of keeping attention on the problem of KP&U as a whole and has prevented many who have investigated pieces of the problem from assuming that they had discovered the key to the larger problem.

In an effort to relate both research and practice, some scholars have conceived the range of phenomena they wished to investigate as "knowledge production and utilization." Both the production and utilization aspects thus are given emphasis in this approach; knowledge, it is assumed, can and should be utilized. Studies within this perspective are somewhat less likely to be concerned with the qualitative effect of the impact of research on practice and are more likely to focus on the dynamics of KP&U as a recurring process. (Boyan, pp. 21-22.) It has therefore been a framework for research which is somewhat removed both from

the concern for improvement of practice and the interests of those in the basic disciplines.* ... Nevertheless, as a research perspective, the conception of KP&U has appealed to these two extremities of the research community as well as to those interested in the process itself.

As an example of the interest of a basic discipline in KP&U, Machlup has put forth what has become a classic of applied economics research in his monumental study of The Production and Distribution of Knowledge in the United States, in which he treats knowledge as a commodity of economic value, produced and used like other more tangible products. Studies of the "knowledge industry", such as Malchup's, while broader in scope than the process of KP&U per se, have opened up avenues of further research that clearly have implications for

* For analyses of differentiations among types of research interests, see Storer, 1968, and Carroll, 1968.

the conduct of research and practice and the resolution of problems of their interrelatedness.

As an example of the interest of a practical field in KP&U, the work of the Cooperative Project for Educational Development (COPED) may be cited. (Watson, Change in School Systems, 1967) Improvement of education through the introduction of innovations was the starting point for the study that drew researchers into questions of KP&U as they explored the development of models and strategies of planned change. It became necessary in this study, as in similar efforts to tackle strategies for improving practice in agriculture and medicine, to turn to scholars who focus directly upon KP&U as an explicit object of study. Advancement of innovations in practice have become possible in a variety of practical fields through similar efforts to study planned change. (Havelock, 1969, pp. 10-53 to 10-64)

Typical of work being done by scholars

especially drawn to the perspective of KP&U as a continuous process is a report on Project Hindsight, a Department of Defense study of the utility of basic scientific and applied research in the development of weapons systems. One paragraph from this report will illustrate the kind of discoveries which research on the KP&U process is turning up and which, if other studies corroborate, will provide considerable understanding of its general fundamentals. The report asserts that:

> "...it is unusual for random, disconnected fragments of scientific knowledge to find application rapidly. It is, rather, the evaluated, compressed, organized, interpreted, and simplified scientific knowledge that we find the most effective connection between the undirected research laboratory and the world of practical affairs." (Sherwin and Isenson, p. 1577)

In reviewing this and other similar studies, Carter has listed some aspects of KP&U that appear to make the matter much more complicated than it would appear at first. He finds that

"knowledge derived from basic research tends to be too general to guide the way for the solution of specific contemporary problems" and therefore such solutions must be sought in the context of specific problem areas. Any one of these problems appears to require a complex and many-faceted solution that integrates a variety of earlier developments and solutions to component problems. Certain conditions for this work seem to be essential -- willingness to confront the practical problem, sufficient trained personnel available on a relatively long-term basis, and adequate financial and administrative support. Rigorous quantitative assessment of the problem situation is necessary if solutions are to be realistically proposed and tested. A new middleman role will very likely be needed to develop new solutions related to the problems and based on basic scientific research and other pertinent data. The dissemination of solutions and their acceptance into practice

are likewise crucial to KP&U. (Carter, 1968, pp. 15-19)

It is clear that much more needs to be known about elements in the process of KP&U than can be derived from examining it in its natural state as a whole. A look at certain dimensions of the larger problem has been undertaken by several scholars, and it is to these other perspectives we now turn.

The Nature of Knowledge Production

The problem of KP&U has been conveniently divided for purposes of study into its two obvious parts -- knowledge production and knowledge utilization -- in the hope that by thus limiting the phenomena of interest, fruitful channels of research may be opened up. Indeed, this has proven to be the case, at least more so than by defining the problem in the terms discussed in the preceding section. A brief review of scholarship in each of these

two domains of phenomena will add to our developing conception of KP&U.

First, taking knowledge production as a problem area, researchers have asked a wide variety of questions and applied various methods of study. Attempts to study the effect on scientific productivity of the amount and kinds of social control, competition, organizational structures for doing research, communication networks, and other factors at work within the scientific community have been among the many interests of scholars in the sociology of science. (Collins, pp. 123-131)* Applied sociologists of science have studied many of these aspects within the field of education.

*An extensive literature is developing around these and other questions (of method, of value, etc.) pursued by sociologists of science. Since this literature appears to be only peripherally related to our topic of KP&U in curriculum, it is not discussed here. However, anyone unaware of this research will find it intriguing to discover the findings on the social determinants of knowledge production. For a comprehensive overview of the sociology of science, see Collins, 1968. An easily understood essay treating the internal social relations of the scientific community may be found in Ziman, 1968. A detailed, comprehensive treatment appears in Storer, 1966.

For example, descriptive accounts of the organizational characteristics, value climates, and research manpower related to educational research were presented in a 1966 Cooperative Research Project study by Sieber and associates at Columbia's Bureau of Applied Social Research. (Sieber, 1966) The difficulties involved in informing colleagues of studies done in educational research were examined by the Center for Research in Scientific Communications at John Hopkins. (Center, 1969) The American Educational Research Association has also been studied with special attention given to its communication and social structure. (Corwin and Sieber, 1968) These studies are providing valuable data on the social, organizational, and communication aspects of knowledge production and hold a number of implications worthy of consideration by those concerned with increasing productivity in educational research.

Closely related to sociological studies of

science are those concerned with the larger questions of the influence of social thought upon knowledge production, which are of interest to the broader discipline of the sociology of knowledge. Karl Mannheim, who is considered the father of this discipline, has developed the thesis that a new kind of objectivity is achievable in the social sciences despite differences in social and ideological perspectives held by individual scientists. Through critical awareness and control of these differences, the validity of knowledge can be determined and sustained. This pushes us directly into problems of epistemology and its various theories of knowledge where criteria of truth are set forth and refined. (Mannheim, pp. 286-306 and Machan, pp. 262-264) Inquiry can be a self-corrective process over time with the production of knowledge continuing to be governed by logical canons of scientific method.

Problems of exactly what constitute appro-

priate methods of inquiry follow from these epistemic questions.* Answers given to these problems and methods actually utilized in research clearly affect the quality of knowledge produced in any discipline or field of study. Classic studies in the nature and methods of scientific inquiry have yet to be discovered by many educational researchers. Methods of inquiry, as understood by decades of researchers in education, have been viewed rather narrowly when applied to problems in education. (Cronbach and Suppes, pp. 32-70; Schutz, 1969, p. 360)** Where careful analysis has been done of the requirements of scientific method and of the character of educational problems, educational researchers have been compelled to reconsider their methods of inquiry.*** They have recognized that an educational problem

* See Scheffler, especially pp. 13-14; Kaplan, especially pp. 304-35; and Nagel, especially pp. 211-213.

** See Kerlinger, 1969, for a rationale for the preference for limited methods of inquiry.

*** Compare Gouldner, 1957.

must be attacked with a variety of modes of inquiry simultaneously. Gowin and Millman's chapter on "Research Methodology" in the December, 1969, Review of Educational Research, is an example of applying to educational research understandings from philosophy of science about the nature of scientific inquiry. The National Academy of Education's recent volume, Disciplined Inquiry for Education, is another. (Cronbach and Suppes, 1969) It distinguishes between conclusion-oriented inquiry, to which the approaches of the basic scientific disciplines apply, and decision-oriented studies, for which different forms of investigation are necessary. In another perspective, Glass reminds us that individual inquiries do not by themselves constitute knowledge. Research literature that accumulates must stand the tests of critical review and organized synthesis before it possesses characteristics of valid knowledge in the most general sense. (Glass,

1970)* Maccia systematically treats methods of inquiry appropriate to educational problems in a way that recovers the full range of options explored by philosophy of science to the conduct of educational research. (Maccia, 1971) One cannot say very much about what is being produced in the way of knowledge, until he has grasped the complexities of the logic of scientific inquiry and mastered the appropriate techniques of research by which he may then assess whatever claims to knowledge are set forth.

Another of the major ways of viewing knowledge production is in terms of its growth. Only the grossest of estimates has ever been made in an effort to pin down how much knowledge is produced and how and why rates of production

*See Etzioni, 1970, for a plea for giving this essential knowledge producing task as much prestige as is given individual inquiries. This task would seem as essential in a problem-oriented field such as education as it is in the basic scientific disciplines.

change from time to time. Historical studies have had to depend upon variations in all the sociological, political, psychological, philosophical, technical, and evaluative factors that we have noted already are tied together in the problem of knowledge production. The same difficulty is recognized in any effort to predict knowledge productivity in the future. Boulding has had to conclude that one cannot predict the future of knowledge production. (Boulding, 1967) Studies of what is happening and has happened certainly are worth pursuing even if only to detect evidence of productivity that is out of balance among various kinds of knowledge, e.g., natural sciences, social sciences, humanities, in terms of particular pragmatic problems needing study. Like any such problems, educational problems can get skewed treatment if no attempt is made to see whether an appropriate balance in kinds of knowledge needed is in fact resulting from the

kinds of inquiries being generated.

Social morality and policy questions have been put to the problems of knowledge production also. The matter of supporting appropriate growth of knowledge just mentioned falls in this category. Morris underlines the opportunity and the dilemma when he states:

> "Knowledge production is gaining and constitutes a significant proportion of our total productive activity. We need to discuss the topic, not just of the production of knowledge but also of its distribution and consumption, in order to observe how the quality of human existence can be enhanced." (Morris, p. 78)

Priorities do have to be set and support rallied for creating knowledge essential to make such choices if men want to enhance their collective life. In education, the NCERD study, cited earlier, (NCERD, 1970), stands as a major example of a nationwide policy science study, bearing on possible decisions about research and development productivity in education.*

*See also Chapter X in this NCERD, 1970, for reviews of other policy studies related to educational research.

It clearly sees the improvement of education as a desirable social priority and recognizes that the creation of a knowledge base for the invention of improved educational practices and processes is a policy issue to which considerable information must be brought if an appropriate societal decision is to be made about it. The report therefore brings the necessary knowledge together from the perspective of the research community.

Znaniecki, in his 1940 volume on The Social Role of the Man of Knowledge, observes what knowledge producers do. His review of the numerous categories of roles* brings us back to sociology of science, but in addition it brings to our attention the differences in the form and kinds of knowledge that necessarily are created by those filling these several roles.

*Explorers of problems (inductive theorists), discoverers of facts, educators, popularizers, historians of knowledge, fighters for truth, contributors, systematizers, discoverers of extended truths, sages, technological experts, technological leaders. (Znaniecki, 1940)

The knowledge they produce is not at once all of the same order. Each no doubt is slightly different in type or form. It should not surprise anyone, therefore, that the very act of producing research and artistic creations in all their many and varied forms has become the object of a specific science, which has substantial accumulations of knowledge to its credit. This science is the science of zetetics. (Tykociner, 1964 and 1966) It is concerned with collecting and systematizing data on the theory and practice of zetesis (the activity of both research and artistic creation) and with the classification and relating of knowledge into a consistent system. At this most general level of discussion of knowledge production, the work of this science, zetetics, is the most central of all the approaches to the study of knowledge production we have reviewed because of its focus upon the thing being produced -- the varieties and forms of knowledge

itself. This realm of study has vast implications for the advancement of knowledge and for ordering the maze of knowledge that has been produced.* It is one that cannot be ignored if the problem of KP&U is to be fully understood and resolved on the basis of increased knowledge of this problem. Whether or not we are able to discover how to control the internal and the external sociological aspects of the problem, or its epistemological and methodological questions, or its policy issues of how much, what kind, and how fast, whatever knowledge is produced and utilized will depend in large measure upon how well we understand the forms and varieties of knowledge themselves and how well we know to what purpose each is suited.

*The work of the late Professor Joseph T. Tykociner of the University of Illinois Department of Electrical Engineering in developing the science of zetetics should be especially stimulating to anyone in the field of education. Its value for exploring the practical problem of selecting and ordering educational content has been brought to the attention of educators through the Fifth Symposium on Educational Research sponsored by Phi Delta Kappa. See Tykociner, 1964.

Knowledge is truly a "protean concept." (Nelson, p. 8)

The Nature of Knowledge Utilization

Like knowledge production, the problem of knowledge utilization has a substantial record of investigation. The use of knowledge has been both observed and conceptualized in its several states, and even the absence of the phenomena (of at least equal interest) has been the object of study. It is widely recognized that the problem of utilization of knowledge needs to be more fully understood if the conduct of practical affairs is to be guided and enlightened by knowledge. Knowledge will no doubt go on being produced whether or not it is utilized, but the ultimate value of producing knowledge would seem clearly to lie in its being used. Knowledge that could be used is often not produced because scholars are unaware of the need for it. Utilization of knowledge would

appear to depend upon a great many factors worth investigating, not the least of which is the presence of knowledge that can be used, to which we have already given attention. Gouldner reminds us of a point that gives some impetus to studying the problem of utilization of knowledge. He says:

> "Pure and applied scientists alike may be relied upon to improve their research technologies and, with this, the scope and reliability of their findings. By itself, however, this will not solve the utilization problem and will not automatically guarantee that these findings will be put to use." (Gouldner, 1965, p. 16)

Something else presumably is necessary. What may be involved, in so far as it has been investigated to date, will be reviewed briefly here. The research on the utilization of knowledge consists of several scholarly approaches and a considerable literature. It will only be possible to sample the major branches of this research.

There is first of all the obvious problem

of locating and retrieving knowledge that has been generated. The creation of mechanisms for information transfer has been thought to be the basic ingredient essential to knowledge utilization. The logic of this approach has a strong appeal, as stated by Carter.

> "If knowledge stays confined to the intimate community in which it originates, it will have little impact on the larger community concerned with application and exploitation of knowledge. To assure that this does not happen we need an effective scientific and technical information and documentation system." (Carter, 1967, p. 2)

In this view, the user of knowledge requires organized assistance in obtaining the results of work done by knowledge producers which may have a bearing upon the practical matter he faces. Elaborate mechanisms have been created or proposed for this purpose, including the traditional processes of publishing and library services, special purpose resource centers, interlocking networks of communication through

which material can be traced, and computerized storage and retrieval systems (Carter, 1967). Among the most useful means of knowledge dissemination is one designed to serve the needs of a specialized group of users through a single, centralized source that caters to its special requirements. Known as an information analysis center, it is technically defined as follows:

> "...a formally structured organizational unit specifically (but not necessarily exclusively) established for the purpose of acquiring, selecting, storing, retrieving, evaluating, analyzing, and synthesizing a body of information and/or data in a clearly defined specialized field or pertaining to a specific mission with the intent of compiling, digesting, repackaging, or otherwise organizing and presenting information and/or data in a form most authoritative, timely and useful to a society of peers and management." (COSATI, 1970, p. iii)*

*This directory lists 119 centers for information analysis in areas ranging from atomic energy to education. See Bruchinal, 1967, for a description of such a mechanism in education, the Educational Resources Information Center (ERIC). See also Clemens, 1967 and 1970. The needs of local schoolmen for information are defined in Coney, 1968. The Far West Laboratory for Educational Research and Development is developing information systems to meet this kind of need.

While these various information transfer procedures are quite valuable in facilitating the delivery of knowledge to users, they have not appeared to be the key to knowledge utilization that early students of the problem believed they might be. Perhaps this consequence should have been anticipated since these technical solutions to the problem were often developed without a full understanding of the problem of knowledge utilization itself.

Social and psychological factors involved in knowledge utilization have been of interest to several scholars whose work sheds light on why access to knowledge is an insufficient condition for its utilization. Even the acquisition of knowledge, as Clark reminds us, "is related to, but by no means the same as, its utilization." (Clark, p. 60) There is a pedagogical problem here. As McGregor puts it:

> "The acquisition of knowledge is a fairly straightforward process provided the individual wants the new

> knowledge. It can be made available to him in several ways. However, if he doesn't want the knowledge or if he doesn't know he needs it, we will have considerable difficulty getting him to learn it." (McGregor, p. 208)

There are requirements imposed upon the process of inducing the state of knowledge in a person to say nothing of the process of applying it. (Ebel, p. 68; Boulding, 1956; Machlup, pp. 13-15) It must be related to the individual's own internal structure of knowledge. There must be feedback to check the truth of the knowledge. Motivational readiness for certain kinds of knowledge must be present. Many more factors could be identified. A person must also recognize an appropriate use for the knowledge if he is to make use of it apart from just knowing it. "Other things being equal, the amount of utilization is likely to increase with esteem for a science and its practitioners," says Schramm (quoted in Gouldner, 1965, p. 17), and thus we move into sociologi-

cal factors at work in knowledge utilization. A number of both direct and indirect influences affect utilization, such as credibility of the source and degree of social support one receives for utilizing the new information. (Havelock, 1969, pp. 5-1 to 5-28) In its organized aspects, knowledge utilization may be inhibited by such factors as the tendency toward stability of the organizational context, its unique purposes, status, and economic condition, and its internal structural hierarchy of roles, reward patterns, and leadership behaviors. The research on organizational factors that may facilitate knowledge utilization has been focused on such phenomena as awareness of outside resources, the capacity to retrieve such resources, the degree of competition and openness to innovation that exists, the training available to personnel, and the opportunity and support for restructuring internal organizational jobs or sub-group

membership. (Havelock, 1969, pp. 6-1 to 6-40) This research on knowledge utilization in general has had its counterpart in education research. Studies on interpersonal relationships between behavioral scientists and school administrators indicate that educators seem to respond to pressure and expectations inherent in their situation rather than to the latest research. There is low attraction, even fear and distrust at times, between the two groups. Sometimes knowledge used in administrative practice is utilized indiscriminantly without reference to the limits the research context would dictate. (Schmuck, pp. 143-165) Sieber has summarized the features of the educational system which uniquely effect the use of research findings: 1) its vulnerability to pressures outside its control, 2) the gap between occupational realities and professional aspirations of educators, 3) the lack of clarity and focus of the terminal goals of

education, and 4) the formal governing and control mechanisms of the system. (Sieber, 1968, pp. 122-136)

Perhaps more research on knowledge utilization has dealt with the phenomenon of innovation or change than any other. This is an area where both an understanding of the phenomenon and strategies for intervention have been sought. Planned change utilizes knowledge and is a natural process which may be studied for its general properties, the dynamics of knowledge utilization, and the effects of various kinds of actions on the change that results. Knowledge of these complex phenomena has taken two major forms -- models and techniques. Three general types of models have been identified by Chin and Benne -- the empirical-rational, the normative-re-educative, and the power-coercive. (Chin and Benne, 1969, pp. 32-59* The empirical-rational type of planned

*See Miles, 1964, for an overview of innovation in educational change. Ward, 1969, reviews the influence of research on the improvement of educational practice.

change is a straightforward one-two-three model. If a proposed change or innovation exists, the adopter recognizes his need for change and is rationally persuaded that the innovation suits his need, and he adopts it. This conceptual stance is one on which many educators have built their repertoire of change techniques and strategies. The educational research and development movement under the auspices of the USOE generally falls in this category. Needs have been determined, solutions developed and packaged, and products disseminated. Though strategies for educational research and development may be devised in various ways depending upon whether one is concerned with policy making for the entire process, primarily interested in producing the needed R & D products, or focusing upon interrelating research, development, and dissemination (NCERD, pp. 1-7), the model of change made operative in such cases is an empirical-

rational one. An important characteristic of this approach is the emphasis placed upon creating knowledge to be utilized in the change process. The importance of having high quality knowledge utilized in innovative educational practices is recognized, and programs are mounted to build and deliver such knowledge to the user. (Chase, pp. 3-4)*

The second type of model of planned change is the normative--re-educative. In approaches of this kind, the person who would utilize new knowledge or innovations must undergo a change of commitment from an old normative orientation to a new pattern of sociocultural norms. This involves change in attitude, values, skills, and relationships, in addition to giving assent to new rationales or knowledge.

* Not only does this article rationalize the need for knowledge in educational practice; it also presents a status study of educational R & D, which, when read in conjunction with Boyan and Mason, 1968, should enable one to grasp the character of this seven year old enterprise.

The stance from which this type of model is derived is found in the work of therapists, trainers, and situation changers. The work of the National Training Laboratories is a well-known example of this approach to planned change. (Chinn and Benne, 1969, pp. 45-46) In education, action research, collaborative inquiry, human relations workshops, and system self-renewal training programs have been developed in keeping with this model. (Havelock, 1970b, pp. 2-7)*

The power-coercive type of planned change includes strategies which employ the principle of compliance. Those with less power comply with the directives and leadership of those with greater power whether legitimately supported by policies and/or the law or more arbitrarily coerced by the application of pressure.

*See also Miles and Lake, 1967, and Watson, 1967, for additional data on planned change in education of the normative--re-educative type.

We are familiar with confrontation politics, strikes and negotiation strategies, and the building of countervailing power to change the decisions of those holding positions of power. In education, power-coercive strategies have increasingly been developed in recent years with tactics designed especially to deal with education's special kind of change problems. (Cunningham, 1967; Kimbrough, 1967 and 1970)

Combining the work of scholars dealing with dissemination of knowledge, psychological and sociological research on utilization of knowledge, and studies of innovation and planned change, Havelock and his colleagues at the Center for Research on Utilization of Scientific Knowledge (CRUSK) at the University of Michigan have chosen to examine the phenomena of knowledge utilization in a way that considers the experience of many applied fields (education, agriculture, medicine, mental health, etc) and integrates the findings related to

the many variables studied in these areas into a wholistic perspective. In so doing, they have conceptualized knowledge utilization as system and as process. (Havelock and Benne, 1967, and Chin, 1969, pp. 297-312) Thus a new discipline has emerged with a large literature, theoretical models, and potential for being applied wherever the problem of knowledge utilization is a deliberate element in the conduct of practice. (Havelock, 1969, pp. 1-1 to 1-25 and 2-1 to 2-43)* This perspective is more congenial to persons in professional and technical fields of practice than the limited context for inquiry represented by studies mentioned up to this point. This is because it is an orientation to the problem as a whole, which is the way it must be faced

*A basic grasp of KP&U can be obtained by a combined understanding of the science of knowledge production -- zetetics (Tykociner, 1966), referred to earlier in this paper, and the science of knowledge utilization (Havelock, 1969), being discussed here.

in practice. Any conceptual understanding of the problem viewed in this way, and any guidelines to practice generated within this understanding, will readily be recognized as matching the complex realities of the world of practice.

The knowledge transfer process, in its simplest form, can be understood as an interaction between a user and a resource. The problem, as studied by CRUSK, is represented by the many-faceted question: Who says what to whom by what channel to what effect for what purpose? A team of university scholars, educators, and publishers, for example, might transfer a new science program they have developed and packaged to science teachers across the country with the hope that it will be adopted and used to improve the scientific understanding of their students. The knowledge flow system, in its most rudimentary elements, can be understood to include this process of

knowledge transfer at work in repeated instances throughout a chain of organizational mechanisms. Someone in the role of knowledge user in one organization becomes the one who functions in the role of providing a knowledge resource in another organization and so on throughout the chain. Basic scientists, for example, provide knowledge which is utilized by applied researchers and developers, who provide knowledge which is utilized by practitioners, who provide knowledge which is utilized by their clients or consumers. In both the process and system of knowledge utilization, as CRUSK conceptualizes them, the phenomenon referred to as "linkage" is a central and pervasive idea. Linkage, in this view, is the key to knowledge utilization. Understanding of who performs linkage roles, how it is done, what approaches yield what results, how institutionalizing the linking functions is done and what results from this

phenomena, what implications may be drawn for practice -- all these contributions to our knowledge of the phenomenon of knowledge utilization make up the unique and valuable research which the perspective taken by CRUSK has made possible. (Havelock, 1969, pp. 1-10 to 1-14 and 7-1 to 7-40; Lippitt and Havelock, 1968, pp. 29-63; Lippitt, 1967)

A typology of knowledge linking roles has been compiled which is worthy of review for its contribution to our understanding of the variety of linkage functions which may be performed and for the differentiation it implies among types of knowledge transmitted. (Havelock, 1968, pp. 64-119) The following tables* summarize these general types of linking roles and related functions and identifies within the field of education specific examples of roles in each category. Detailed discussion of these roles may be found in references cited with each example.

*These tables are developed and adapted from data in Havelock, 1968, pp. 65-93.

Table 1

THREE GENERAL CLASSES OF KNOWLEDGE LINKERS

	1	2	3
Type Role:	Conveyor or Carrier	Consultant	Trainer
Examples in Education:	Teachers Trainers, Informers, Demonstrators: Disseminators	Change Agent	Teacher Professor of Practice Trainer
Function:	To transmit knowledge from producers to users; tells "what"	To assist users in identification of problems and resources; links to resources; facilitates; observes objectively; diagnoses; tells "how"	To instill in the user an understanding of an entire area of knowledge or practice prior to his entry into a work setting
Knowledge Requirement:	a widespread general role--often problematic; must possess whatever knowledge is to be utilized	an advisory role-- specialized technical knowledge essential but not the knowledge to be utilized	a preparatory role--an expert in large quantities of knowledge and/or complex skills; needs both abstract and applied knowledge related to the practice area
References:	Clark and Hopkins, 1966*	Jung and Lippitt, 1966 Benne, Chin, Bennis, 1969	Jung, 1967 Clark and Hopkins, 1966

*This reference includes a treatment of diffusion roles within the context of the research-development-diffusion-adoption continuum. Since this model has extensive currency among educators, it may be instructive to note the development of refinements of this model since its original formulation. Recognition of the complexity of linkage has increasingly affected the elements in the model. The following sources represent in chronological order of their original presentation the successive modifications made by the creators of the model and others who have built upon it: Guba and Clark, 1965; Clark and Guba, 1967; Clark and Hopkins, 1966; Mackenzie, 1970; Stufflebeam, 1966; Clark, 19 7; Guba, 1968b; Guba, 1968a; Guba, 1970.

Table 2

TWO CLASSES OF LINKERS IN RESOURCE SYSTEM

	4	5
Type Role:	Basic Scientist or Scholar	Translator or Adaptor
Examples in Education:	Gatekeeper to the World of Science Supreme Generalist and General Educator Definers of Basic Human Values and Directions Future Planner or Futurist	Educational Researcher-developer R&D Manager, Coordinator, Director Educational Engineer Curriculum Developer
Function:	maintain standards for what counts as knowledge; defends and champions it; considers its implications and integrates findings into theories or overviews; helps users think through purposes and assumptions of utilizing knowledge; defines parameters of future knowledge requirements	To translate work of basic scientists and scholars into usable "applications" in a given field of practice; invents solutions to operating problems; designs, field tests, and evaluates programs, products, or services prior to their adoption
Knowledge Requirements:	An authoritative, expert role; number limited in each area of expertize--knowledge processed in encyclopedic, thoroughly scrutinized, and "packed down" forms	A bridging role--must know all scientific and scholarly knowledge pertinent to a field of practice and the needs of that field of practice for configurations of knowledge that facilitate practice; must possess a dual orientation--toward both research and application--and the capacity to generate knowledge that reconciles the two within a single context
References:	Znaniecki, 1940 Morris, 1969	Clark and Hopkins, 1966 Sieber, 1966 Anderson, 1961 Clark, 1965 Babcock, 1965 Miles, 1967

Table 3

FIVE CLASSES OF LINKERS IN CLIENT SYSTEM

	6	7	8	9	10
Type Role:	Opinion Leader	Innovator	Defender	Practitioner	User
Examples in Education:	Superintendent Principal	Teacher Administrator Demonstration Center Staff	Evaluator "Quality Controller"	Teacher Administrator Teacher Trainer Other Educators	Pupil Public Parents Educators
Function:	To influence within his group the receptivity to new ideas and practices; provides an example or direction to follow; lends social support and legitimation for their adoption	To be the first to use, demonstrate, and advocate a new idea in his group or setting; initiates diffusion and stimulates adoption	To sensitize the user to pitfalls of innovations, and forestall change until risks are examined; evaluates scientific and practical basis of the new idea	To transfer new knowledge to clients, the public, students, etc. through services, practices, or products	To take initiative on one's own behalf to seek out scientific knowledge and derive useful learnings therefrom
Knowledge Requirements:	a limited, but powerful and strategic role--must be familiar with the particular knowledge offered as potentially useful and with assessments of its merit for practice; must have competent knowledge of his setting such that he can judge suitability for utilization in it	a limited technical role--knowledge of how the innovation would effect practice; technical knowledge of its application; positive information on advisability of adoption	a limited technical role-- knowledge of how the innovation would effect practice; technical knowledge of its application; negative information on advisability of adoption	a widespread general role--a wide range of knowledge useful in dealing with the user's problem must be at his command; diagnostic information of user's problem; technical skill in providing delivery	a limited,highly developed role; seldom fulfilled-requires adequate knowledge of resources, fully accessible; requires adequate self-diagnostic capability; must possess whatever knowledge is utilized without the aid of intermediary linkage roles
References:	Carlson, 1964	Rogers, 1962	Guba, 1968a Stufflebeam, 1966 Guba, 1970, pp. 46-49 Hencley, 1967		Havelock and Benne, 1967 Rogers, 1962

From this classification of linking roles it may be suggested that knowledge utilization depends not only upon the response of the one providing the knowledge but also upon who delivers it, what function he is performing at the particular time, and how thoroughly in possession of the required knowledge he is. The use of the concept of linkage as a perspective from which to study knowledge utilization is indeed a promising and fruitful one.

A typology of messages which are created and utilized in the phenomenon of linkage has also been developed by CRUSK. (Havelock, 1969, pp. 8-1 to 8-51) A brief examination of this message component of knowledge utilization will conclude this review of research on the nature of knowledge utilization. Linkers both receive or possess knowledge and transform it into knowledge that can be utilized by others. The character of this knowledge, as has been

observed, varies with the linking role under discussion and the needs of the client receiving it. The flow of knowledge or linking messages involves four systems in which linkers function--the basic research system, the applied research and development system, the practice system, and the user system. Reduced to the simplicity of these four systems, the categories of linking messages associated with each can be set forth and discussed in abstract terms. There is no implication in this conceptualization that messages always flow from the first system to the second, then to the third, and on to the fourth. Messages may flow among and between them in a number of ways that do not conform to this order. (Havelock, 1969, pp. 8-32 to 8-37)*

*The relationships among knowledge types have been classified into sixteen different types of transformations that occur. A practical prototype developed by the applied research and development system, for example, can be tested and provided for the use of persons performing in the practice system; some other development efforts may be disseminated directly to the consumer without going through the practice system; still other messages may by conveyed to the basic research system which may then conduct new basic inquiries because of the stimulus of this additional input.

The basic research system generates three major types of messages which may then be conveyed by linkers to persons that can utilize them in this same system or in other systems. This basic knowledge includes general theories, laws, or principles; data or the factual and empirical elements found in the phenomenon studied; and method or the way by which the data or theories are verified or their truth claims are determined. Studies within the psychology of the learning process would be examples of research which generates knowledge of these types. (Havelock, 1969, pp. 8-3 to 8-10)

The applied research and development system produces seven types of knowledge that can be transformed by linkers into usable messages. There is theory again, but it is different from basic theory. Its purpose is to provide broad principles to guide the behavior of practitioners. Theories of teaching,

curriculum development, and educational administration are illustrations of this type of applied research and development theory in the field of education. Data in the form of theory testing, diagnostic data resulting from describing a problem, and data that is derived from evaluating a solution to a practical problem are three additional types of messages that linkers may transfer to users. A fifth type would include techniques, tests, instruments, and the like which make up the specialized tools of applied research and development methods. Designs may also be developed by fusing theory data and method into something new. This sixth type of knowledge available to linkers is necessarily an elaborated idea produced in general form with specifications from which a seventh type of knowledge may be developed--what are often called prototypes. These are inventions or solutions that are specific concrete knowledge

packages oriented toward practice, usually but not always derived from an earlier general design, often but not always based upon basic or applied scientific knowledge. A teaching strategy, an experimental computer program, the product of a curriculum reform project would be examples of prototypes in education that are ready for field testing and refinement and, once satisfactorily evaluated and revised, ready for dissemination and use. (Havelock, 1969, 8-10 to 8-17)

Messages generated within the practice system are in the form of either services or products or a combination of both. These types of practice knowledge are conveyed to the user after the practitioner has determined which form is appropriate and whether the form that is appropriate is available in prototype or must be developed and then communicated. Once available he may make the necessary transformations to fit the client's situation and

provide whatever facilitative service is required to complete a successful linkage. An example of a service in education would be the employment of a unit of instruction in a teacher-pupil interactive setting. Examples of "hardware" products would be a computer arrangement or building designed for specific educational uses. "Software" products might take the form of programs of instruction developed and packaged in books, videotapes, curricular plans, etc. Combinations of these occur when, for example, an educational industry provides a computerized system of instruction, supplies both the hardware and the software, and services the staff with in-service education on how to utilize the new system. (Havelock, 1969, 8-17 to 8-23)

User system output includes messages expressing the user's needs or problems, and when resources are brought to bear on his situation, feedback to the supplier about the

degree of need reduction and satisfaction or dissatisfaction the solution has brought. (Havelock, 1969, 8-24 to 8-20)

The whole of this typology of linkage messages may not appear to be particularly illuminating. However, if particular examples of knowledge being transferred from a resource to a user are examined within the context of distinctions made in this typology of messages, considerable difference emerges between classifications on such questions as the scientific status of the knowledge, value loading, all-or-none acceptance, complexity, communicability, compatibility with receiver's system, and relative advantage to user. (Havelock, 1969, 8-38 to 8-51) A number of excellent possibilities for research on knowledge utilization open up which relate to the nature of the knowledge transferred in the linkage process.

It is important to recognize that with research on dissemination mechanisms, the

social and psychological factors in knowledge utilization, the phenomenon of innovation and planned change, the nature of knowledge transfer processes and systems, and linkage roles and messages the complexity of knowledge utilization has increasingly yielded to clearer understanding and control. This research suggests the need to develop strategies for effective linkage which fully take into account the various findings discovered in studying knowledge utilization from these several perspectives. The discovery that the phenomenon cannot be viewed simplistically as a problem of moving knowledge from one kind of source (the research community) to one kind of user (the practitioner) means that a whole series of linkage strategies must be devised, each suited to its particular place in the whole system and to its particular function and particular message translation task.* It

*CRUSK has begun to prepare guidelines of this sort in various fields of practice. See Havelock, 1970a, for an example prepared for introducing innovation into education.

also means that persons can no longer be content to conduct their own piece of the total enterprise without understanding the way it is conceived by those other persons to whom they are related and on whom their own work impinges. Gideonse has noted that in educational research, development, and practice "there are obligations on both research and development to transfer their products to other activities" in such a way that it will advance "the likelihood of their being incorporated ultimately into practice" and will render the processes for doing so explicit enough that they can be followed. This means, he adds, that both research and development "must pay careful attention to the way in which its outputs are presented (and how they are of use to one another) and, perhaps, the very way in which the outputs are produced." (Gideonse,

1968, pp. 543, 544)* Thus, an understanding of utilization of knowledge is bound to affect matters of production of knowledge and another research perspective is opened up.

This review of studies related to the general problem of knowledge production and utilization has dealt briefly and therefore selectively with several dimensions of the basic problem. Research cited here which attempts to chart the problem, either comprehensively or in particular fields, significantly adds to the store of knowledge available to those persons engaged in activities which center around the production of knowledge or its utilization and makes possible further refine-

*This article presents a model that permits examination of the outputs of research, development, and operations. A variety of starting points, linkage paths, and knowledge requirements necessary for dealing with several kinds of knowledge utilization problems are illustrated. Technological guidelines for each possible kind of problem should be developed to incorporate research findings available on linkage and knowledge utilization.

ment and development of the practices associated with the conduct of these activities. The quest for useful knowledge in any field of practical endeavor, including the many branches of educational practice, can be illuminated by a clearer understanding of the many aspects of knowledge production and utilization to which this review has referred.

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