SCHOOLING AND THE ACQUISITION OF KNOWLEDGE

Edited by

RICHARD C. ANDERSON
RAND J. SPIRO
University of Illinois at Urbana-Champaign

WILLIAM E. MONTAGUE
Navy Personnel Research and Development Center

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Preface

During the past decade and a half there has been a ferment in psychology. Fifteen years ago few psychologists would have called themselves psycholinguists, and almost none would have used the designation cognitive psychologist. Now these designations are as familiar as the traditional label—experimental psychologist. The shift in the names psychologists use to describe themselves signals important changes in areas of inquiry. Whereas in the past most research in human experimental psychology involved paired-associate learning, free recall of word lists, or the identification of arbitrary concepts from stylized geometric patterns, a larger and larger proportion of papers in the literature now deal with more natural units of human communication and understanding such as sentences, stories, and text. The whole point of view about what constitutes the proper goal of psychology has changed. Formerly it was construed to be the discovery of lawful relationships between observable stimuli and observable responses. Assumptions about what goes on under the skin were to be made cautiously, if at all. Now human experimental psychology takes as its proper goal modeling what the mind knows and how it knows.

Meanwhile, by and large, educational research workers who look to psychology for inspiration have continued their twenty-year love affair with behaviorism. Make no mistake, we would not care to question the practical benefits of contingency management techniques under certain circumstances. And, most certainly, we would not deny the important contributions of the instructional technology movement which, while behaviorist in origin, increasingly displays a cognitive coloration in the hands of its most skillful practitioners. Nonetheless, at the present time, work in cognitive psychology and related fields has had only modest impact on the thinking of educational researchers, and virtually no disciplined application to instructional practice. Given the increasing emphasis on ecological validity in cognitive psychology, this state of affairs need not persist.

So it was that a group of psychologists, educators, and philosophers convened under technicolor-blue skies on Shelter Island in San Diego harbor late in November of 1975 to reflect on schooling and the acquisition of knowledge. The group was interdisciplinary in character because of our conviction that the questions posed could be resolved only by the consolidation and integration of knowledge from diverse specialized domains. The one common thread running through all of the formal papers and dialogue was that the knowledge a person already possesses is the principal determiner of what that individual can learn from an educational experience. These questions were addressed: How is knowledge organized? How does knowledge develop? How is knowledge retrieved and used? What instructional techniques promise to facilitate the acquisition of new knowledge? The kinds of answers provided are characterized by their breadth as well as by their specificity. Accordingly, the volume should be of interest to both the generalist and the specialist.

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Richard C. Anderson, *Urbana, Illinois*
Rand J. Spiro, *Urbana, Illinois*
William E. Montague, *San Diego, California*

Contents

1

Types of Knowledge and Purposes of Education

H. S. Broudy

University of Illinois, Urbana

The physical scientist, psychologist, humanist, epistemologist, and educator all take knowledge for their domain, but it is sometimes difficult to recognize their maps, classifications, and directions as applying to a common territory. Consider, for example, a few of the classifications of knowledge that have achieved prominence in the history of philosophy. The four stages distinguished by Plato in the figure of the divided line in *The Republic* has had remarkable endurance. So have Aristotle's distinctions between the kinds of knowing involved in understanding, making, and choosing.[1] Kant's distinction between a priori and a posteriori knowledge, echoing the old division between intuitive knowledge of principle and empirical knowledge of fact, and the antagonism between the scientific search for truth and the humanistic one are other examples. Some classifications are based on the nature of the subject matter being studied; some on the methods of studying it. Some are characterized by their epistemic status, for example, the differences between opinion, belief, and knowledge; between knowledge by acquaintance and knowledge by description (Russell, 1912) or Gilbert Ryle's distinction between knowing that and knowing how (Ryle, 1949).

Compare the questions that an epistemologist, psychologist, humanist, and educator might ask of a discipline X.

Epistemologist: What is the logical structure of X? What are the entities, relations that enter into its laws or generalizations? What are its modes of inquiry, and what are the criteria for the validity of its results?

Psychologist: How does one discover the structure of X? How do people learn this structure? Are there stages in this process? What factors are involved in the success or failure of the process?

[1] In *Metaphysics*, $1025^{6}25$, Aristotle divides the sciences into the theoretical, practical, and productive, the ultimate goals of which respectively are knowledge, conduct, and the making of useful or beautiful objects.

Humanist: What is the import of X for human goals? What is its significance for humanity and for individual selves?

Educator: How does what the psychologist or epistemologist say about the learning of X help in the teaching of X? How does what the humanist says about X figure in the teaching of X or in deciding whether or not X should be taught and to whom?

Missing from this list of knowledge constituencies is the ordinary consumer and user of knowledge. Ever since formal schooling was established, it has been assumed that knowledge acquired in school would be used to enhance the quality of human life. The investment in schools was supposed to yield a return in the form of greater adequacy in occupational, civic, and personal development. There has never been a lack of critics who doubted the causal nexus between success in school and success in life. In spite of such skepticism, the faith and investment in formal schooling persist.

To understand this anomaly it may be instructive to look at some of the differences in types of knowledge, the interest of specialists who deal with knowledge, and the ways knowledge is used. It is suggested here that, in part, the anomaly rests on a mistaken orthodoxy concerning the relation between school learnings and their subsequent uses, an orthodoxy that ought to be reexamined.

I. TYPES OF KNOWLEDGE

How individuals came to have knowledge was once a standard philosophical topic. Descartes posited certain innate ideas; Locke denied their existence and argued for *tabula rasa* on which ideas and impressions of sense were recorded, combined, and retrieved. Plato's theory of recollection and Aristotle's theory of cognitive functions are also accounts of how knowledge is acquired. To a considerable extent the conclusions drawn by Plato and Aristotle regarding sensation, perception, imagination, memory, and reasoning of various sorts, are still used in psychology as well as in philosophy. Aristotle, Plato, Descartes, and other philosophers constructed their theories about the origin and development of knowledge by asking what processes and entities would be required to explain the existence of opinion, belief, and – if possible – certainty. Aristotle's postulate of active and passive intellect and Kant's forms of intuition are examples of this kind of philosophical-psychological theory resulting from observation and logical analysis of concepts of knowledge rather than from systematic empirical investigation.

As the empirical study of human behavior and mental functioning developed, the distinction became sharper between generalizations of the psychological processes and the structural-logical properties of knowledge. Today, it is generally recognized that psychology, in principle at least, should be able to say how

men come to their beliefs, but psychologists are not expected to decide whether these beliefs are justified. These judgments are made authoritatively by specialists within the various disciplines to whom the data, the relevant evidence, and criteria of validity are familiar. Accordingly, as the special disciplines developed, the questions reserved for the epistemologist were reduced to those concerned with the justification of various types of truth claims and of the possibility of truth in general. As a result of this development, the relevance of epistemology to the empirical sciences and the humanistic studies becomes more and more attenuated. Epistemology tends to become a metadiscipline which the workers in the several disciplines think they can safely ignore. Thus, many nuclear physicists do not feel the need to study philosophy of science.

Epistemology by its classifications, distinctions, and theories draws attention of psychologists to loci of inquiry just as any system of terminology does, but not all philosophical questions are of equal interest to the psychologist or the educator. For example, the acres of philosophical arguments on whether or not there can be certainty in knowledge are of little immediate interest to psychologists, although an analytic psychologist might be interested in the motives that enable philosophers to devote their professional lives to formulating issues in a way that insures their unsolvability.

By contrast, a theory of knowledge and truth such as that propounded by William James, Charles Peirce, and latterly by John Dewey is of immediate interest to the educational psychologists because it suggests a method of teaching. Thus, if the truth (James) or meaning (Peirce) or warranted assertion (Dewey) can be achieved by traversing or reenacting the complete existential act of thought, we have a neat union between epistemology and psychology. The connection between Kantian epistemology and Piagetian genetic psychology is interesting for the same reason. Nevertheless, the tradition that there is a fundamental difference between the order of knowledge and discovery and between the logical and psychological orders of learning is a strong one.

The concreteness of particulars flowing together in the continuity of experience is never quite exhausted by the abstract categories used to analyze and describe these experiences, albeit psychology stays closer to this concreteness than do the sciences dealing with bodies, animate and inanimate. The humanistic disciplines, as will be noted, claim to stay closer to the human reality than any of the scientific ones. The educator, dealing with particulars – pupils – views all abstractions with extreme caution. Unlike the researcher, he does not see individuals as data for generalization, but as unique events. This ineluctable difference in perspective does not bode well for a science of education.

Nevertheless, the educator cannot be indifferent to the way knowledge is construed and dealt with by psychology, philosophy, and the humanities because his task is to unite the particularity of pupils with the universality of knowledge. Different types of knowledge make different claims on the curriculum, and justifying their place in the curriculum very soon takes on philosophical dimensions. The actual teaching transaction, moreover, is partly prescribed

by the way the disciplines, the repositories of the different types of knowledge, are organized as conceptual systems. Setting the stage for the transaction whereby the forms of knowledge, in Aristotelian terms, become the forms of an individual mind is in the psychological-pedagogical sector. The difference between setting the stage for the act of comprehension and the structure of what is comprehended can be as great as that which obtains between the work of stage hands and that of the playwright.

Of the numerous distinctions among the types of knowledge that might be discussed, I have chosen three contrasts that persist not only as theoretical problems, but also as matters of educational policy.

A. Knowledge as Structure and Process

Knowledge as a system of statements about entities, relations, and theories in some domain of inquiry has its own logical properties and criteria. The theory explaining the existential process whereby these inquiries were instituted, carried on, and arrived at also has a structure (causal, developmental) but one not necessarily identical with the logical properties of the conceptual system being learned. How Einstein came to formulate the principle of relativity is not evident in the equations expressing that principle, just as the vicissitudes of Euclid's cogitations are not evident in the theorems bearing his name. To be sure, an accurate account of what went on in the life of Einstein and Euclid would contain references to relativity theory and geometry, even, perhaps, the statement or the equations and theorems themselves. However, it would contain much more, some of it having little relation to these statements. In other words, psychological generalizations about the thinking of scientists are not interchangeable with the product of that thinking, and this would apply to the generalizations of psychology itself as a science.

This discrepancy is important to education in several respects. For one thing, the logical structure of a discipline may not give any useful direction as to how the pupil may discover or learn it. Hence there is the pedagogical task of uniting the biography of a discipline (the history of its problems) with the results of the attempts to solve these problems. The PSSC (Physical Science Study Committee) physics curriculum is a notable example of how this can be done, but it took effort, money, and an unusual concern for the problems of schooling on the part of physicists to help bring it about.

In the second place, there is the temptation to argue that to think scientifically is more important than mastery of a body of scientific knowledge. A rivalry is thus set up between practicing the process and appropriating the product. For a bright high-school student, PSSC physics provides a good balance between the two, but often creates the impression that being scientific in spirit makes it unnecessary to study its letter. This enrages disciplinarians, who forget that many of their students who have studied the letter are not scientific in spirit.

Finally, the ability to comprehend conceptual systems is one of the most widely recognized indices of intellectual quality. Since Plato there has been a strong tradition – never without its detractors – that theory people are "better" than and certainly rarer than the practice people. A curriculum that stresses conceptual ability is highly abstract and easily outdistances the capacity and patience of many members – perhaps most – of the school population. In recent years this tradition has been challenged by at least two demands: one, that the professors (theory people) had better do something useful in coping with our social predicaments or lose financial support; and two, young people who want to go to college should not be prevented from doing so by academic standards that stress a high abstraction potential.

B. Scientific versus Humanistic Knowledge

Scientific and humanistic studies constitute another major contrast in the types of knowledge important to the psychologist and the educator. One expects from psychology scientific descriptions about the human psyche. But the human reality includes components that, in a literal sense, do not exist. Elements such as goals, aspirations, conscience, anxiety, regret, and repentance, refer to states in the past or future. What sort of science deals with phenomena that gain their significance from what is not yet or no longer is? On a positivistic theory of knowledge, we can apparently know nothing about this kind of reality.

Yet, it is precisely with phenomena that have nonexistent referents that the humanistic disciplines are primarily concerned. They purport to seek knowledge about human happiness and misery (not simply pleasure and pain). But in what sense can such conclusions be knowledge (i.e., justified true propositions)? They are neither inferred from controlled experiments nor are they statistical inductions from representative samples. On the contrary, a single experience may be taken as conclusive evidence of humanistic truth, like a religious conversion, a revelation, or the experience of a Job, Jesus, or Buddha. A particular image in a work of art may reveal a universal truth about the human condition (Macbeth, Guernica). These may be called exemplars, and they are not communicated by direct assertion (Broudy, 1961).

The evidence for the assertions "The sun is 93 million miles from the earth" and "I know that my Redeemer liveth" are not of the same order. The self-evidence of mathematical tautologies is not the same as that entailed by "Beauty is its own excuse." Humanistic truth or knowledge involves something other than logical or scientific validity. Perhaps it is authenticity. Authenticity is the property of being genuine, nonfake, as really issuing from the source that claims to originate it.

Authenticity is closely related to credibility. But while credibility is concerned with whether we should believe that P is not false or a lie, authenticity has more to do with whether the asserting Self is the real origin of an assertion or an act.

Thus, if I say that Mozart is a great composer it may be an authentic judgment that issues from my own experience, reflection, and evaluation. But it may also be an echo of a music critic who, for me, has high credibility in matters Mozartian.

Although we judge the credibility of persons by their access to the facts, this is not the sole or even the most important condition. We are really interested in grounds for believing the speaker is not lying. Sometimes this ground is provided by evidence that the speaker has no interest that would be served by deception, or because what he asserts may be contrary to his own interests. Sometimes a lack of sophistication is taken as evidence of sincerity, but more often we are convinced by a belief that So-and-So is not the sort of person who would deceive.

Authenticity is a property of an autonomous self. The evidence for the authenticity of an assertion P, therefore, is its congruence with the value system of such an autonomous self. It is the truth by which that self is willing to live or, if necessary, to die. Clearly, this kind of truth and evidence has different meanings than the same terms in science.

Do we have here a clue to the difference between scientific and humanistic knowledge? Scientific knowledge makes truth claims that can be assessed without raising the question of the credibility or authenticity of their author because, in principle at least, the assertion can be verified publicly by those who are competent and willing to give it a try. Humanistic knowledge, on the contrary, is about the value commitments of the race or the species as exemplified in the value systems of selves, real or imagined. About the only evidence we can adduce for the truth of these systems is that autonomous selves have regarded them as worthy of commitment and, indeed, of the highest commitment. This kind of knowledge we can possess in two forms; (1) as knowledge about the commitments that have been reported in this or that period by this or that person, and (2) as recognition of the claims of our own commitments, for we too are, or are trying to become, autonomous selves. Science is concerned primarily with truth; humanistic studies with authenticity.[2]

One of the earliest insights into the difference between natural science and humanistic knowledge came from Giambattista Vico (1668–1744). Vico argued that mathematics owed its success not to its correspondence with reality, but to the circumstance that its objects were constructed so as to be related logically in

[2] A case can be made for a cognitive mechanism that protects the integrity of a value system. If, for example, courage is a quality of behavior that has been generally admired and cultivated in the history of the race, not only will it acquire a kind of survival value, but it may become a parameter limiting the meaning of "human". In other words, those members of the group who do not interiorize the value of courage and experience no obligation to display behavior comportable with it are branded as non-human and treated accordingly, and this treatment is usually different from that meted out to those members who know the value and nature of courage but have failed to exercise that virtue.

a deductive system, once certain axioms and notions were accepted as given. Physicists, astronomers, and biologists, on the other hand, do not construct the objects of their investigations, hence they can never fully explain the "why" of physical phenomena. Only their Creator aware of His purpose and their ends could do this. If there were a kind of reality that human beings created and the purpose of which they knew and considered in the making, then one could hope to have explanatory knowledge of it. Human action (as distinguished from other kinds of behavior) is such a reality.

Two points follow from this for Vico. (1) A natural science of men treated as purely natural entities . . . rests on a cardinal error, for it gratuitously bars itself from what we can best understand. (2) We can reconstruct and recapture the collective experience of the race through their collective expressions in myth, rite, and language. Thus, according to Isaiah Berlin (1974), the methodological question for the understanding of human history is to ask ". . . what the experience of a particular society must have been for this or that myth, or method of worship, or language, or building to have been their characteristic expression" (p. 36). This, of course, undercuts the notion of a fixed human nature and a natural law that prescribes the ends of man, but it creates the possibility of a humanistic "science" of history.[3]

This difference between scientific and humanistic knowledge engenders a clash between two cultures, and occurs in every curriculum debate from elementary school through college. The guilds serving as custodians of one kind of knowledge rarely speak to the guildsmen serving the other. Only the classroom teacher in the elementary school is denied the privilege of specialization in one of these domains and the luxury of ignorance in the others.

C. Validity versus Utility

The third difference is between the noetic quality of a discipline which includes concepts, relations, theories, modes of inquiry and criteria of validity, and the individual or social usefulness of that knowledge. It is the difference between the questions: "What is good physics?" and "What is physics good for?"

Physics, mathematics, chemistry, biology, psychology, and even history and the arts can be used to further this or that human purpose, but the applications are not directly derived from the conceptual contents of these disciplines. The science of genetics, for example, tells us nothing about the human needs for hybrid corn or the desirability of preventing congenital defects in human beings. And although the problems of food and health stimulate the study of chemistry and biology, these needs do not determine the logical structure of these disciplines, the doctrines of Marx and Mao to the contrary notwithstanding. It is only

[3] For a concise account of Vico's life and doctrines see Vico (1944, 1965). The latter volume also contains a bibliography on works by Vico and about him.

when a technology does not perform properly that we ask whether some scientific principle is not being forgotten or misunderstood. As a rule, this is resorted to only after more technological inquiries fail to yield a remedy. As to the application of the humanistic studies, one need only look into these studies themselves to realize how much soul searching and reflection intervene between a moral principle and a commitment to a given act presumed to be comformable to it.

Schools are expected to be committed to teaching the contents of selected bodies of knowledge and to their social and individual utility. The teaching of chemistry is justified by its usefulness in many areas of commerce and industry; instruction in the humanities is justified by expected improvement in citizenship and a reduction in savagery of all kinds. Conversely, it is argued that if no use from a study can be demonstrated, then the subject ought not to be studied. Usefulness has at least two interpretations: (1) direct application to life tasks most frequently encountered by the average citizen, for example, driving an automobile or filling out a tax return, and (2) general application to wide ranges of phenomena, like mathematics, symbolic skills, critical thinking. The first interpretation favors a curriculum that is a sample of the cognitive and motor skills constituting the common life tasks. These are the identical elements upon which Thorndike relied for transfer. Indeed, there is a constant pressure on the schools to practice the tasks themselves and not to bother with transfer at all. The second interpretation relies heavily on Charles Judd's theory of transfer via generalization and gives support to a discipline curriculum. Because neither type of transfer seems to be as automatic or as predictable as one would wish, teaching for transfer is still a prime pedagogical task. Great reliance on transfer is regarded as one of the characteristics of education as distinguished from training. If generalizing requires a higher order of abstract intelligence than practicing a particular performance, then schooling may be polarized into reasoning for the elite and practice for the masses. This is embarrassing to a culture that is committed to abolishing this distinction.

For the professional and business elites in our society, theory and practice may very well converge. Theoretical competence is essential to a modern technological society, and very high rewards await those who can combine theory and utility. But that all members of society need to become knowledgeable about either science or technology is far less obvious, chiefly because the more developed the technology that goes into the production of automobiles, refrigerators, airplanes, and other blessings of a modern society, the less the consumer needs to understand how these products are made or why they function as they do.[4]

[4] This is related to Karl Mannheim's distinction between functional and substantial rationality of a social system. The functional rationality of a bureaucratic system diminishes the need for rationality in the citizens; indeed, if they persist in efforts to understand it,