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# SCIENCE, SCHOOLING, AND SOCIETY: TOWARD AN INTEGRATED CURRICULUM

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Those of us who have participated in the curriculum movement over the past decade have seen a profound change in the orientation of curriculum makers during this period. In the wave of science-based curriculum projects that followed the launching of Sputnik in 1957 there was little explicit attention given to the social purposes of instruction. The emphasis in those years was on the transmission of knowledge in the most economical form through the identification of central ideas, and on the invention of pedagogical techniques that supported and reinforced the child's natural curiosity and desire to learn. One of the most influential thinkers of the period, Jean Piaget, turned the attention of curriculum makers almost exclusively to the child's processes of cognitive growth, and to individual differences in learning style. Another, Jerome Bruner, wrote an immensely popular book, *The Process of Education*, that stressed the most effective ways of organizing the transmission of knowledge, while making only passing reference to the social purposes of instruction.

During those years, no one talked much about the emergence of the child as a social creature. The failure of these early reformers to consider the moral dimension of learning has left us with some troubling problems. While the curriculum leaders of the sixties were enormously effective in extending the scope of the curriculum to include many new areas of knowledge, and were equally inventive in developing new pedagogical approaches and techniques, they neglected to evolve a unifying social purpose for their reforms. Thus, inadvertently, they contributed to the curriculum fragmentation that we face today. The growing disaffection of both high school and college students from a curriculum that fails to relate learning to real-life problems is a measure of how far we still must go to close the gap between curriculum development and social need.

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Now we are in the midst of a second wave of curriculum reform that is attempting to respond to these new demands. Where physics teachers were once content to enliven the teaching of their subject by having students "do physics" rather than read about it, now they are striving to help students "do something useful with physics," like unscramble a traffic jam or design a better security system. Where before it was enough to examine pond water to expose the mysteries of the ecosystem, now students are asked to apply such knowledge to solve pollution problems or to debate questions of environmental planning. Even in the social studies classroom, where it used to be sufficient to contrast comparative political structures or explore the diversity of cultural patterning, teachers are now pressed to think about how new knowledge about human behavior can be used to construct a more livable world. In these new efforts, we can begin to discover the broad outlines of an approach to curriculum making that relates the teaching of "disciplines" to the needs of society. Such an approach could chart a path to a more integrated curriculum.

The excitement and magnitude of the task we face are perhaps best illustrated if we examine a specific case. In 1970, a group of scholars, teachers, and curriculum writers assembled at Education Development Center in Cambridge, Massachusetts, to begin designing an interdisciplinary social studies course for high school students. Our intent was to create a course that would draw upon the best current thinking in both the natural and social science disciplines—particularly biology, anthropology, psychology, and sociology—to help students understand what it means to be a human being. Implicit in our approach was the assumption that knowledge of human behavior is an important psychological anchor for adolescents growing up in a world of rapid social change. We hoped that such a course would provide students with an appreciation of their own psychological uniqueness, an awareness of their kinship with other members of their own culture, and an understanding of the biological and behavioral characteristics that unite the human race as a whole.

It did not take us long to discover that no academic discipline within the natural or social sciences was adequate to cope with the questions we wanted to raise. Most of the interesting issues in the study of human behavior fall *between* disciplines. Take as an example a two-year-old asking for a drink of water. To begin to understand so basic a behavior, one would have to consult at least half a dozen scholars: a physiologist on the anatomy of vocalization; a biologist on

differences between verbal and non-verbal communication; a child development specialist on stages of development; a social psychologist on the process of acquisition; an anthropologist on cultural differences; a linguist on matters of syntax and structure; and so forth. Clearly, the university was organized into a set of arbitrary departments that, separately, bore little relation to the problems we wanted to discuss.

Having found the conventional disciplines to be of marginal usefulness to us in framing the problems and devising the conceptual framework for our course, we proceeded to organize materials around issues that appeared to be interesting to students: child-rearing practices, male-female differences, love and affection, expressions of fear and anger, parent-offspring conflict, etc. We then sought support from different departments of the university to clarify how we were approaching these questions. It soon became apparent that academics from different disciplines often use different words to discuss the same (or nearly the same) phenomena, and that these words are invested with quite different associations and meanings. A biologist, for example, speaks of "bonding" when examining relationships between male and female or between parent and offspring, while a psychologist may use words like "love" or "attachment." Similarly, a psychologist talks of "anxiety" and "hostility" when discussing conflict between individuals, while an anthropologist is inclined to use terms like "dominance" and "aggression." Accommodating differences in usage is no easy matter, for such differences often reflect fundamentally variant viewpoints about the way a specific behavior can be explained.

Still another problem that plagued our work was the discovery that the "disciplines" not only represented separate languages and tools of analysis, but also drew upon bodies of data that did not overlap. Evolutionary biologists are free to do their work unchallenged so long as they confine their investigation to animal behavior, leaving out *Homo sapiens*. Anthropologists are safe examining preliterate cultures, but suspect when they put their tools to work on recorded history. Psychologists may examine interpersonal behavior, as long as they don't extrapolate their findings to a theory of society. Academics from different intellectual traditions are deprived of the opportunity to learn from each other, because the academy supports the autonomy of its departments and fails to encourage cross-disciplinary study of similar phenomena. Needless to say, both scholarship and the cause of general education are impoverished as a result.

The deepest and perhaps most troubling problem we have encoun-

tered has been the struggle to accommodate the differences between the natural and social sciences. The cleavage between these two areas of knowledge runs so deep as to constitute, in extreme cases, fundamentally different points of view regarding the nature of humankind. Our encounter with these differences grew out of our effort to combine perspectives from biology with insights drawn from anthropology, psychology, and sociology. At the heart of these differences seem to be conflicting opinions as to whether human behavior can be understood with reference to the process of evolution by natural selection. On one side there are social scientists who go so far as to assert that cultural evolution proceeds quite independent of biological factors. The other side proclaims the primacy of biological forces in understanding human behavior.

For our purposes, neither view is satisfactory, for it is precisely in the *interaction* of biology and culture that we find some of the most interesting insights into human behavior. Take weeping, for example. Biology tells us that the female hormone estrogen predisposes a person to cry. Not surprisingly, it turns out that women in all cultures, so far as we know, are inclined to weep more than men. At the same time, we know that different cultures develop different expectations about when weeping is appropriate, some tending toward stoicism, others inclining toward emotionally expressive behavior. This can lead to wide variations in weeping behavior among men and women. Men in some cultures are likely to weep more than women in other cultures. Both biological and environmental influences seem equally important in this case.

Perhaps a more interesting example is what we have learned through interdisciplinary studies about the nature of learning. Stimulus-response psychology has told us for years that rats and, presumably, human beings are shaped almost entirely by their responses to negative and positive stimuli within the environment: they act to seek pleasure and avoid pain, and can be taught or "conditioned" to do anything if we manipulate the external stimuli. Recent experiments, however, reveal that rats can be taught to avoid food of a certain flavor if they experience artificially induced nausea several hours after eating. The rats are not taught to associate food of a particular size and shape with the delayed sickness, only food of a particular flavor. This suggests that the rat brain is not an undifferentiated organism shaped entirely by the external environment but is predisposed by natural selection to react differently to different external stimuli. The rats' re-

sponse is logical in this case, because poison is more likely to be associated with taste than with size in the real world.

Extrapolating to human beings, it is reasonable to postulate that we are also predisposed by our evolutionary past to respond differentially to environmental forces, and are not simply the passive recipients of stimulus-response shaping. Boys, for example, are inclined to engage in rough-and-tumble play in all cultures, regardless of efforts made to extinguish it: as every junior high school teacher knows, some boys will endure considerable punishment without changing their behavior. Similarly, newborn infants, as John Bowlby has demonstrated, can elicit different care-taking behaviors from their mothers through different types of crying that appear to have an evolutionary origin. Dr. Spock may advise an American woman to behave quite differently toward her baby than a Bushman mother does, but such advice is *not* likely to alter the behavior of the baby very much.

The power of combining insights from both biology and social science in an examination of human behavior is also demonstrated in the study of pair bonding and the evolution of the human family. While anthropology exposes us to the diversity of family structures around the world—monogamy, polygamy, polyandry, etc.—social science alone cannot explain the persistence of the family as the fundamental unit of society, despite profound changes in culture and numerous experiments with other forms of social organization. Biology reframes the question: “Why should natural selection favor pair bonding between human males and females, and the investment of energy by males in the care of their own offspring?” Pair bonding exists in most species of birds, but in only five percent of all other species. In chimpanzees, our closest primate relatives, the males have no lasting pair bond with females, and make little or no investment in the care of the young. Why, then, should human beings demonstrate this rare adaptation of prolonged pair bonding between male and female—the basis of the human family?

By asking the question in this way we can see how biology informs the social sciences. Evolutionary theory can help us to see how, over five million years of human evolution, selection pressures have favored a pair bond between male and female that facilitates economic diversity—division of labor for hunting and gathering, for example—and that ensures maximum care and protection of the young. Clearly, those males who were predisposed to stay with females had greater reproductive success, and it was their genes that survived. What bi-

ology helps us to see is that underlying the surface diversity of cultural patterning lies a set of biological forces that interact with culture to produce particular behaviors. Thus, by combining the insights of biology with those of anthropology, we are able to provide students with a more comprehensive way of thinking about human nature than any single discipline allows.

These examples suggest the excitement and the freshness of viewpoint that can emerge from a deliberate effort to examine human behavior from new and multiple perspectives. Many of you have probably experienced a similar exhilaration in applying the interdisciplinary approach to other areas of the curriculum, such as environmental studies. Here the natural and social sciences can interact to explain the workings of the ecosphere, and to frame the crucial issues of our relationship to the environment that must be resolved if human society as we know it is to survive. Books like Barry Commoner's *The Closing Circle* demonstrate the need for an interdisciplinary approach to understanding our ecological problems. Commoner criticizes the way we teach:

Life, as we live it, is not encompassed by a single academic discipline. Real problems that touch our lives and impinge on what we value rarely fit into the neat categories of the college catalogue, such as physical chemistry, nuclear physics, or molecular biology. . . . To encompass in our minds the terrifying deterioration of our cities, we need to know not only the principles of economics, architecture, and social planning, but also the physics and chemistry of the air, the biology of water systems, and the ecology of the domestic rat and the cockroach. In a word, we need to understand science and technology that is relevant to the human condition.\*

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\* Barry Commoner, *The Closing Circle* (New York: Alfred A. Knopf, 1971), p. 189.