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Science Education—Process or Content?

It is undeniable that our science curricula have in part failed, even the newest and the best of them, to deal sufficiently with the role of science in the making of human culture, with the problems of the present world and the fair or dread vision of the future of man.

Nothing that man grasps for as betterment is unalloyed. Our old folk and fairy tales knew this full well. In our latter-day faith in progress it has been forgotten that the reward and the disillusion are intermixed. Should not our science courses avoid both the siren song of progress toward a perfect technological culture and the horrendous fear of unavoidable technological doom?

In problem after problem we find that only a total analysis of effects—physical, chemical, biological, psychological—can define the risk or militate against the danger. It may be that the most needed new type of agency in all countries is one that would apply the fullest possible systems analysis to each and every new technological discovery prior to its introduction. Why do our science curricula fail to deal with such questions? Why is the future public not acquainted with the grave issues it must face?

The benefits and risks of our scientific and technological developments cannot be appreciated except in the context of sufficient understanding of both the nature of science as process and the nature of science as content. Here investigation, inquiry, and organized knowledge and conceptual schemes go hand in hand. After all, there are two primary functions of science education: the one, the technical or empirical, being to transmit and extend the knowledge requisite to human power; the other, the philosophical, being to develop an understanding of man's place in the universe. The former, which no one has delineated better than Carl Becker in *Progress and Power*, is the basis of all cultural development, the fundamental thread of human history. The latter has enabled man to conquer superstition and fear, to open his eyes to an illimitable vision. If man's hope for progress is not to prove a delusion, if his fear of malign external forces is not to be replaced by an even greater fear of man himself, the study of the sciences must be bent to the task.

We live, it may be said, in a crisis of conflicting values. That is not new for man. Always his own desires have in some measure found themselves opposed to the family, the tribe, or the state. The submergence of the individual in the enormous populations and national cataclysms of our times is a mere climax or aggravation of the unending struggle, at least in Western lands, to prize and safeguard the rights and worth of the individual. The natural sciences have played a great part in this historic drama. As John Dewey said, already in 1903, "Science has become incarnate in our immediate attitude toward the world about us, and is embodied in that world itself"; and even more pertinently, "Any scene of action which is social is *also* cosmic or physical. It is also biological. Hence the absolute impossibility of ruling out the physical and biological sciences from bearing upon ethical science."

There may yet be hope for mankind, since from the perspective of a geneticist the present conflicts of human racial groups appear evanescent, and from the perspective of a psychologist the motivation of nations to war seems conquerable. What is necessary is insight, and insight may come through learning, if we study the right things in the right way.—BENTLEY GLASS, *Vice President for Academic Affairs, State University of New York, Stony Brook*