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# The Iowa Academy of Science as a Directing Influence in Science Education

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The last decade was marked by drastic changes in the studied approach to teaching science and most school subjects. A whole new vocabulary of science education terminology appeared—the process approach, conceptual schemes,



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integrated science, audio-tutorial techniques, the multi-media approach, computer-assisted instruction. These and many other phrases can be summed up in the one word *innovation*, and many educators of the more traditional bent feel a bit uneasy and perhaps defensive about the extent to which innovation is lacking in their teaching. Some teachers may feel the effects of “future shock”—somewhat like that vague uneasiness called cultural shock that develops after the first captivating effect that a foreign environment has on, say, a Peace Corps volunteer. Experienced teachers

are finding themselves in the midst of a proliferating environment of computers, film loops, open-ended laboratory courses, individualized instruction, and behavioral objectives, much of which is foreign in a real sense.

As we enter the decade of the 70s, well-informed educators are turning their attention more and more to the impact of science and technology on society and our environment. The fuse of the “population bomb” is growing ever shorter. More and more teachers in the high schools and colleges feel constrained but not necessarily qualified to interrupt “business as usual” to discuss the seemingly unsolvable problems that the inevitable population explosion will bring. The habit of thinking of the future as an era around some obscure distant corner is out of tune with the times. The future is upon us and many of us are being caught unprepared in spite of the proliferation of new curricula. It is not always easy for a teacher to answer questions such as, “Why do you include this particular content in your course?” or “What exactly do you hope to accomplish by teaching the course at all?” Traditional methods of teaching science have not been replaced by a revolutionary methodology even though courses designated by initials like CHEMS, BSCS, PSSC, IPS, etc., appear as offerings in many schools. These and other new courses have not been wholeheartedly received in many schools and although they have contributed immeasurably to an improvement of some kinds of science teaching, the proper

function of science teaching in modern society continues to be elusive. In terms of promoting "scientific literacy," the teaching of science in the secondary schools and in the colleges has not produced gratifying results, even in recent years. As stated by Morris Shamos:

... we should question why, in the light of all that has happened in the past few decades to point up the significant role of science in this and future generations, so many students still avoid science even as a cultural imperative, and their parents continue to display their ignorance of this field almost as a badge of honor.

As science teachers, we may find it difficult to imagine that the fault is ours, yet we must be realistic about it. No matter how one may try to rationalize the situation, the fact remains that most of our neighbors are ignorant of science, and whatever exposure they have had to this discipline has been of our making. The logical conclusion may be unpleasant but it is inescapable. Either science is basically unteachable (in the usual sense) or we have simply not yet discovered how to teach it.<sup>1</sup>

The logic of Shamos' conclusion may appear to be open to question, considering the current surplus of physicists and other science personnel with advanced degrees. For these individuals, some kind of science apparently was learnable, if not teachable, but the science learned by such specialists is not what Professor Shamos is concerned about. The concern is with the polarization that our science teaching evidently produces—the separation of the general public from the scientifically literate. This is manifest in the marked alteration in the attitude of the public toward scientists in recent years. Writing in the *Saturday Review* of December 2, 1969, Dr. Rene Dubos stated some of the reasons for this change of attitude. He pointed out that such things as the discovery of fire, the domestication of animals and plants, the development of irrigation of urban centers, the emergence of great religions and complex political systems, etc., have profoundly revolutionized human life even more perhaps than modern science is doing today. While changes in the past were very profound, in general they spread slowly and thus allowed for the progressive development of adaptive processes, both biological and social. In contrast, the effects of modern science and technology reach suddenly into the physical and mental lives of immense numbers of people and affect simultaneously all aspects of society. Such increase in the rate of effects amounts to a real qualitative difference, and it is to this increase in the rate of effects that Dr. Dubos attributes the alteration in the public attitude toward scientists.

Another factor that has contributed to public disenchantment with "science" is the failure of science to pay off promissory notes (as Dr. Dubos calls them) made in the form of extravagant claims concerning the results to be expected from scientific research. Public funds have been the primary source of support of scientific research, and scientists have found that they must advertise

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<sup>1</sup> Morris H. Shamos, "The Role of Major Conceptual Schemes in Science Education," *The Science Teacher*, January, 1966, pp. 27-30.

their activities in order to obtain financial support. Extravagant claims have often resulted, some ranging from the proposed development of supposedly practical matters such as perfect control of the weather to nonpractical matters having spectacular appeal such as the imminent chemical synthesis of life or the possibility of communication with mysterious creatures that may populate celestial bodies.

Such overselling of extravagant claims in the 60s tended to encourage a lazy acceptance on the part of the public of the belief that scientists would solve all the problems of the modern world by inventing new technologies. Some teenagers argue that they need not take to heart the advice to avoid cigarettes because the scientists will surely discover a cure for lung cancer. Some industrialists and politicians argue that environmental pollution is not a real concern of theirs because surely scientists will find a way to clean the air of our cities and the water of our streams and lakes. Some dismiss the prospect of overpopulation as a problem because science will surely invent new kinds of food and ways of settling people on the moon or on the floors of the ocean. After all, we did accomplish the feat of putting man on the moon.

Many of these impressions continue to be fostered by the kind of science teaching that exalts "science" beyond its rightful place as a human enterprise. To change this the philosophical and social uncertainties that are emerging from scientific progress must be taken into consideration in planning goals for the teaching of science. These must be considered just as much as the prospects of technological breakthroughs. Steps must be taken to increase scientific awareness, and this is not necessarily the same as up-to-date knowledge of recent developments. It is a fallacy to say that the understanding of science on the part of the citizen, the worker, the consumer, and the parent is being accomplished by improving the science curricula in the schools. In the first place only a small proportion of students take enough science in high school and college to prepare them for the world of tomorrow (actually the world of *today*). Even more important, scientific knowledge is increasing so rapidly that much of what a young person needs to understand as an adult is not even in existence at the time he is in school. One of the first necessities then would seem to be to increase the enrollment in science courses in the high school and in the college. However, this will not produce the desired effect unless most students enroll in courses having attainable objectives that are consistent with our rapidly changing society and environment. The attitude that "science is not for everyone," so commonly held by science teachers, cannot foster greater scientific literacy on the part of the public.

Many of the state academies of science are becoming more aware of the important function that they can perform in improving the public's knowledge of the role of the scientist in modern society. The interdisciplinary nature of the Iowa Academy of Science puts it in a unique position to help in this regard because it includes members from all levels of instruction, both public and private, as well as scientists not directly concerned with education. The his-

tory of the Iowa Academy goes back about as far as the teaching of science in the high schools and the simple objective of the Academy as stated in the constitution has taken on broader meaning in recent years in the same way that educational goals have been modified to keep pace with the times. The only objective stated in the constitution is the "encouragement of scientific work in the state of Iowa" and is broad enough to include any activity that creates a more favorable climate for the scientific enterprise.

In order to accommodate the future encouragement of scientific work in this state, the Iowa Academy of Science should take some cues from the AAAS Commission on Science Education. Certainly scientific work of any kind must start with appropriate education at an early age and continue through the entire period of formal education and beyond. The Commission is now devoting a major effort to studies of needs in science education in the 1970s, ranging from the preservice and inservice training of elementary school science teachers, through a project to develop new guidelines for preparation programs for secondary teachers of science and mathematics with more emphasis on interdisciplinary programs and the social implications of science. These efforts will be national in scope and specific recommendations will have to be adapted to the specific needs of smaller geographical areas. The state academies of science are in a position to shorten the feedback loop between national planning and local implementation.

The Iowa Academy of Science should be more intimately in touch with all members of the academic community concerned with the teaching of science at all levels, the State Department of Public Instruction, and the nonacademic scientific community, so that a variety of activities could be coordinated involving curricular developments, teacher certification requirements, and improvement of the public's knowledge of the role of the scientist in modern society. Included in this involvement should be more concern for science in the two-year colleges and vocational-technical schools, especially the latter. Speaking before the Academy Conference of the AAAS in December, 1969, Howard Foncannon of the AAAS Commission on Science Education made the following comments:

. . . Technical education is a new sector in American higher education. The demands for technicians trained at the college level are rapidly increasing, and the technical education institutions are far from able to meet the need.

Like every other major sector of education, technical education is beset by many problems which must be solved quickly and effectively. Many of these problems can be solved only with the help of the scientific community. Since most technical education institutions (primarily junior and community colleges and technical institutes) are geared primarily to meet local needs for technical personnel, the Academies are in a favorable position to offer positive and effective help.

He described some of the problem areas in which the state academies might be able to provide assistance, particularly in the areas of need for cooperative work-study programs and the need for recognition of faculty and students as

bona fide members of the science-technology community. His only specific recommendation was that each academy study the problems and consider the forming of a special committee to explore the contributions that the academy might make to technical education within its jurisdiction.

The Iowa Academy of Science has for many years been vitally concerned with science education. The Visiting Scientist Program provided one kind of liaison between the specialist in scientific research and the classroom. The Junior Academy Research Symposium continues to encourage science-prone high school students to engage in individual research as junior scientists. The Iowa Science Talent Search Committee makes use of entries submitted to the national Science Talent Search to locate and recognize Iowa scientific talent in the high schools. The Excellence in Teaching Awards program attempts to locate high school science and mathematics teachers who are doing outstanding work in their professions. The Science Teaching Section conducts regional meetings during the winter months for science teachers in the elementary and secondary schools, often in conjunction with Junior Academy meetings; this section also sponsors a Science Teachers Short Course conducted in March at Iowa State University and prepares the sectional program for the April meeting of the Academy. All of these activities and the Articulation Conferences for Two-Year and Four-Year Colleges held in 1966, 1967, and 1968 required the dedication of many Academy members to professional goals of inestimable benefit to the state of Iowa. But there is much more to do along a much wider front.

Working through the Iowa Academy of Science, many of us can make a contribution to solving some of the problems considered in this paper. The task is so large that no institutional group is likely to have the motivation to undertake it. The Academy can function effectively to take on many of these problems as no other group can because it has no self-interest to promote; the object of the organization is simply "the encouragement of scientific work in Iowa."