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**Editorial**

**National Standards**

The American Association for the Advancement of Science, through its Project 2061, has designed a series of standards for science education in American schools. The National Research Council, through its Center for Science, Mathematics, and Engineering Education, has also designed standards for science education in American schools. The two sets are remarkably similar.

The NRC, in collaboration with the National Council for the Teaching of Mathematics, has prepared a set of standards for mathematics education in American schools.

The science standards and the mathematics standards have received widespread approbation from scientists, mathematicians and educators. As excellent and important as they are, the standards are unlikely to enrich American education as long as they remain solely a series of recommendations without an effective program of implementation. To affect science and math education in American schools through a series of standards requires a two step process. Step One is to design a series of recommendations for the standards. That has largely been accomplished. Step Two is to activate a program of implementation that includes the publication of appropriate textbook materials and the in-service and pre-service preparation of teachers.

The two step process is similar to the Research and Development of physical products. Perhaps, to bring change in education to fruition, we should have a parallel sequence. The Development phase might more usefully be construed as implementation.

The importance of the implementation step may be appreciated from the following example.

The publication of Darwin's *Origin of Species* in 1859 had little impact on high school biology textbooks. Those in general use in American high schools following the publication of the *Origin*, for the most part, did not include accounts of evolution.

In 1895, the Committee on Secondary School Studies of the National Education Association (a.k.a. the Committee of Ten) recommended that evolution be taught in high school biology courses.

In 1906, the American Society of Zoologists made a similar recommendation.

In 1923, prominent biology educator, George Hunter of Knox College, made a similar recommendation.

In 1931, a committee of the North Central Association of Colleges and Secondary Schools made a similar recommendation.

In 1941, the national Commission on Cooperative Curriculum Planning made a similar recommendation.

Despite many recommendations by respected individuals and regional and national groups, according to Oscar Riddle, by 1942 less than half of our teachers were including organic evolution in their classes. Furthermore, four states, Tennessee, Louisiana, Arkansas, and Mississippi, actually had enacted legislation prohibiting the teaching of evolution in their public schools.

After several years of preparation, in 1963 the Biological Sciences Curriculum Study released three textbooks with evolution as a major theme. The textbooks were published commercially and they, and subsequent imitators, largely replaced the textbooks that had been in use. Summer and academic year institutes focused on those books were attended by large numbers of teachers. Evolution finally was being widely taught in American schools—104 years after the publication of the *Origin of Species*. Soon the anti-evolution laws of Tennessee, Arkansas, Louisiana and Mississippi were either repealed or declared unconstitutional.

The appearance of evolution in biology classrooms did not come about as a result of numerous recommendations by prestigious national and regional committees but, rather, because of an effective program of implementation that included the publication of textbooks and training sessions for teachers.

The national standards for science and mathematics education deserve to be the guide posts for the instruction of those subjects in our schools. So long as they remain simply sets of recommendations by distinguished groups of scholars they will, unfortunately, have little impact on the teaching of science and mathematics in our schools. Step Two, the implementation step, must be taken if science and mathematics education are to profit from the standards that have been developed.

The preparation of the thoughtful reports that propose standards for science and mathematics education is a potentially major contribution for the improvement of education in our schools. The scientists, mathematicians and educators who developed those documents deserve commendation. They also deserve to see serious attempts made to implement their recommendations. It would be most appropriate for one or both of the lead organizations, NRC and AAAS, to bring about the commercial publication of conforming texts as well as appropriate in-service and pre-service training for teachers.

To neglect to exercise that leadership deprives our schools of significant educational resources that now are potentially available.

Arnold B. Grobman  
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