A PROPOSED SCIENCE CURRICULUM FOR THE PUBLIC SCHOOLS

DOUGLAS E. LAWSON
Southern Illinois Normal University, Carbondale

The results of numerous research investigations and the examination of several hundred courses of study in science, show the following facts:

Fact 1.—The science curriculum of the American schools historically has been based upon three questionable hypotheses: (a) That through science study, the human mind can be strengthened in its innate "faculties" or capacities; (b) that the best values of science teaching are classical rather than utilitarian; and (c) that the chief immediate function of science in the high school is that of pre-professional or college-preparatory training.

Fact 2.—The majority of students in the schools of America traditionally have been unable to profit in any large degree from the classical type of science curriculum. This for three reasons, namely: (a) The curriculum was too difficult for those within the normal span of native intelligence; (b) the program was poorly allied with the apperceptional background and the real needs of the students; and (c) the methods of teaching were sometimes—though not always—faulty.

Fact 3.—As a result of the hold that classical and traditional values and methods have had upon the schools, the modern science curriculum in most schools is still anachronistic, marking a distinct hysteresis between social needs and educational planning to meet those needs.

Fact 4.—Although some of the burden of responsibility must rest with the teachers of science themselves; some of it with the lethargy of public opinion; and some of it with the college professors who have written the science textbooks and determined the college entrance requirements, a large share rests with the inertia and lack of social vision among public school administrators and their boards of education.

So much for the facts that are chiefly historical. Some facts indicative of the future may perhaps be stated somewhat as follows:

Fact 1.—There appears to be some hope that the near future will see a really substantial financial support for science teaching, with adequate funds for plant facilities, laboratory equipment, and teaching staffs.

Fact 2.—In the present, we are experiencing a transition from classical and pre-professional objectives to the utilitarian or vocational-domestic objectives. But the present chaos is so complete that one needs merely examine a few dozen courses of science from American high schools to see that any clear-cut and universally acceptable statement of objectives—to put the matter poetically—will likely be a long time a-borning. The fact was clearly pointed out by the Committee on the Function of Science in General Education[1]; and in the subsequent eight years the situation has improved but little.

Fact 3.—The trends in curriculum indicate a significant movement now under way to integrate science with numerous areas of human living. The evidence is in such courses as those dealing with the science of home sanitation; the chemistry of cooking; the

[1] Progressive Education Association, *Report of the Committee on the Function of Science in General Education*, pp. 13-17. New York: D. Appleton-Century Co., Inc., 1938.

relation between physiology (especially endocrinology) on the one hand and human personality and behavior on the other; courses in automobile mechanics; science applied to home nursing; the science of agriculture and horticulture; science in relation to marriage, eugenics, child care, pre-natal care, etc.; science in courses on consumer purchasing and propaganda analysis; home building; home making, and the like. One looks in vain through school reports of half a century or a century ago for such courses. By contrast, the courses were highly regimented. The content was encyclopaedic knowledge to be memorized. There were vast lists of scientific classifications. But there was very little laboratory experiment and—except for the examination of so-called natural objects—little activity of any kind and almost no integration whatsoever. Perhaps the apex of classical terminology was reached with Boston's program for 1870, in which was listed a course that may have been physics or mathematics or both. Taught in grade twelve, it was called "The Theory of Indeterminates of the Infinite and the Infinitesimal of Imaginary Quantities."[2]

Fact 4.—The fourth fact in evidence is a corollary of the third. The high school in particular, once considered as the seed-bed for each year's crop of college freshmen, has at last recognized the fact that 75 or 80 percent of high-school graduates will not go to college.[3] The college entrance requirements are beginning to lose their dominant influence upon the high-school curriculum; and the science program, partially freed from these bonds and partially impelled by the obvious needs of the mass of students, is beginning to descend from its ivy-covered tower to work in the home, the machine shop, the garage, the farm fields, the nursery, and even in the kitchen. This fact does not mean that science has deserted the high prerogatives of speculative investigation into the nature of the cosmos or the search for eternal verities and respectable principles. But it does mean that that part of its offering which makes up the public school curriculum at last is being measured in terms of the most probable and best life needs of the students. It means that specialization is at last being left to the colleges and the institutes and to the technological and scientific foundations.

With these facts now as a background, there is a temptation to project a future curriculum for purposes of contrast. Such prediction is perhaps a combination of measuring the trends and of expressing a hope. The latter part may be permissible if it rests upon reasonable probabilities.

For such a contrast, then, let us point to the requirements in science recommended by the Committee on the Course of Study of the National Education Association of 1876[4]. For the years of elementary education it recommended geography and some oral lessons in natural philosophy and natural history. That was all. And for the high school it recommended natural philosophy, chemistry, physics, botany, zoology, and physiology. That was 1876.

Now, the following program, it may be hoped, will be typical for the school by 1976. And it is proposed only after most careful examination of present trends, the opinions of

[2] *Annual Report of the School Committee of the City of Boston, 1870*, p. 309. Boston: 1871.
[3] Gwynn shows 22% going to college (Gwynn, J. Minor). *Curriculum Principles and Social Trends*, p. 347. New York: Macmillan Co., 1943.
[4] National Education Association, *Journal of Addresses and Proceedings*, pp. 58-68. For the year 1876.

competent curriculum specialists, and the reports of many investigations which have inquired into the needs of growing boys and girls in the present social order.

I. *For primary grades:*
- Nature study of local flowers, birds, trees, resources, and weather phenomena;
- Health factors and practice in diet, cleanliness, and sickness prevention;
- Local science and industry, with excursions to dairies, museums, farms, mines, lakes, forests, rivers, factories, etc.;
- Beginning of botany and zoology through school gardens, excursions, the raising of pets; collection of specimens;
- Home science in practice of safety, simple cooking, sanitation; and introduction to costs and values of food and clothing.

II. *For upper elementary grades and junior high:*
- Geography in integrated units with geology, botany, history;
- Botany and zoology through field excursions; study and collection of specimens; beginning of textbook study;
- Geography through integration with agriculture on school farm; experiment with study of soil, erosion control, etc.;
- Human biology and physiology begun through study of health; elementary genetics; laboratory work in diet, cooking, sanitation, child care, and consumer purchasing—all in school home economics and nursery departments or in school cottages especially equipped;
- Chemistry through integration with home economics in laboratory study of foods, textiles, woods, varnishes, paints, cleaning compounds, and other common articles of home consumption;
- Chemistry and health integrated in study of local sources of water and milk supply, home cooking and canning, diet, bacterial analyses, and pest control;
- Astronomy through observation and beginning textbook study;
- Home mechanics integrated with general home planning, design, manual training, industrial design, home repair;
- Automobile mechanics and elementary physics through shop work in specially equipped industrial shops of the schools;
- Health and mechanics integrated in safety education, analysis and correction of hazards in the home; organization of safety patrols;
- Agriculture, geography, and geology integrated with zoology, horticulture, and botany in experience program with school farm, involving stock raising, seed selecting and hybridization, pest control, conservation, reforestation, etc.

III. *For grades 9-12:*
- *Required:* human biology, including genetics; physical and mental health.
- *Alternate or elective:* all other areas of science, with the understanding that any course will be offered for which there is demand by sufficient students to comprise a class.

In curriculum planning for the science program, both in the required and alternate courses (but not in the free electives), a formula can be established to determine whether any particular fact or skill should be required. The formula may be stated as *Utility plus One*, the "One" being either universality of use, frequency of need, or cruciality of need. This simple formula for these courses can be applied as the criterion for every single element of the science curriculum, every item of every textbook, and every skill taught in the laboratory. Let us apply the formula, for example, to Newton's familiar law. Is this law useful—does it have what we call "Utility"? Undoubtedly it has. Then we must ask, Is this knowledge such as to be universally needed? That is, is it used by the butcher, the baker, and the candlestick maker? Apparently not; but it can still be justified if it has frequency of need by the majority of people. But it does not have. Then, does it have cruciality? Again the answer is no. So, though it does have utility, it will not be required.

By contrast, certain facts about automobile driving would be required because they meet the criterion of universality. Some facts of first-aid would be required because of cruciality.

The protest is often made that these newer trends in the science curriculum introduce materials of learning that are not academically respectable. The answer is simply that anything which adds to human happiness is academically respectable. Anything that reduces human drudgery in the kitchen, on the farm, in the factory, or elsewhere; anything that reduces sickness, injury, superstitution, gullibility, wastefulness, and other sources of human misery—anything, in short, which takes the child where he lives and improves his health, citizenship, vocational competence, personality adjustment, or worthy use of leisure time, is, *ipso facto*, respectable. Without class distinction, the new program moves toward the ultimate goal of all living, the goal of human happiness.

Science should be a part of the work of all elementary grades and of from two to four years of the high school.

The objectives for the teaching of science should be:

1. To develop skills and acquire habits and knowledge of science that will function immediately and in the ordinary lives of all students;

2. To develop appreciation of the full part played by science in our changing technological and social order;

3. To develop appreciation of the method of science as involving control of variables, freedom from prejudiced observation, cautious accuracy, the withholding of judgment, and the exact use of principles;

4. To develop appreciation of scientific development as a heritage from the labors of many men and generations of men; and a sense of responsibility socially in putting the resources of science to desirable uses;

5. To acquire a utilitarian mastery of the specific science skills most commonly needed in such frequent or crucial situations as involve health habits; safety; food; consumer purchasing; automobile mechanics; vocations; recreation; household management; and the obtaining of accurate information and professionally competent advice;

6. Recognition of science as the essential avenue of civilized man in his long search for truth; and, consequently, an ideal which holds, as essential for human progress, the rights of free scientific inquiry at all costs and the dissemination of scientific evidences of whatsoever kind.