Evaluation And The Science Curriculum

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One of the greatest dangers facing science teachers today is the tendency to be complacent, to have a false degree of security that new science programs provide the answers to our science teaching problems.

The new science curricula, such as the BSCS, CHEM, CBA and PSSC, were designed by groups of scientists and science teachers. These groups took into account the latest science research but had little concern for educational research. Specifically, the content in science was revised to keep abreast of the latest scientific research, and little or no attention was given to the *goals* of science teaching.

Why teach science? From the revised curricula, it appears that the major function of teaching science is to train the gifted or talented student in science and/or to train scientists or technicians. This emphasis has been the result of Sputnik. It follows the typical pattern of teaching science in Russia. Perhaps we should take a serious look at our goals of science teaching and of our aims of education in an American democracy before we plunge into curriculum changes.

Critics of the new developments are very much concerned about many average and slightly below average students who cannot benefit much from these revised science curricula and about students who are not being taught science for the purposes of general education. In several programs, an evaluation was made of different student groups with the same instrument. The goals of instruction were not differentiated for these different groups. Thus, many questions have been raised about evaluation in these new science programs.

WEAKNESSES IN THE NEW PROGRAMS

In teaching science for what is presumably general education in the new curricula, very little attention is given to the philosophy and history of science, the development of scientific ideas with relation to the understanding of the scientists, and the social implications of science. No specific directions are included to help develop science understandings or concept formation at various levels and with different types of students.

Three or more national versions of a science syllabus cannot meet the local needs, abilities, and interests of students in a given community. What is seriously lacking is the opportunity for teachers to become creative and to include certain topics in their science teaching in accord with their own talents and interests. Some topics such as marine life in Hawaii should be a vital part of a secondary school biology program in Hawaii. This topic, however, is not included in nationwide syllabi. Each school and every science teacher should have a very active role to play in the construction and re-evaluation of their science curriculum.

Although it is recognized that much good is reflected in the development of these new curricula, serious limitations and possible dangers in their use may be due to the following:

1. the continued use of uniform curricula which will be out of date in the near future;
2. the almost complete dependency on one series of pamphlets and/or one assigned text; the failure to use varied periodicals and several texts to bring science information up to date;
3. the complacency of teachers or administrators who accept a new program without further evaluation because a group of experts designed it;
4. the ignoring of the interests and abilities of individual students;
5. the failure to use local resources to supplement the curriculum;
6. the failure to encourage in-

dividual science teachers to include other topics that could be related to pupil interests or extending interests in science in accordance with the teacher's interest and ability;

7. the failure to develop evaluation materials that measure scientific attitudes, problem solving abilities, social implications and applications, as well as the ability to change overt behavior as a result of understanding science.

Pencil-paper tests alone will not be sufficient to evaluate all of these objectives. Will teachers be given the necessary time to plan, to observe, to think through and to write additional evaluations of pupils? If greater demands to evaluate are made of teachers, they should be given extra time or assistance.

One of the problems of finding out what our pupils really learn in science is to study the changes that take place in their understanding, thinking, and using of science from one grade to the next and from the elementary to the junior or senior high school. How many schools provide for an evaluation of such growth in knowledge, attitudes, and in skills? How can a topnotch course in biology and in chemistry in grades 9 and 10 be taught most effectively without any consideration given to the organization and articulation of a science program from kindergarten through the twelfth grades? Do each of the science teachers know how much or how little their students know at the beginning of the course? Without such knowledge, how can the science teacher actually determine the growth of the learner and his achievement of science information from a given course of instruction?

PRINCIPLES FOR EVALUATION

Perhaps the following guiding principles can be used in establishing evaluation procedures for a program and in preventing a curriculum from becoming out of date:

1. *Are representative classroom teachers from all grades (K-12) invited to evaluate the curriculum?* Since evaluation must begin and continue in the classroom, it is important that science teachers play an active role in determining the aims, content, and learning activities of science. Without this activity, many of the principles and aims of science can be overlooked easily. Unless a teacher believes in the curriculum, he will not be able to teach it effectively.

2. *Are science education consultants invited to work with the classroom science teachers?* It is important that specialists bring in the latest research about the *teaching* of science as well as scientific research. Educational research in science teaching can offer effective ways of developing several of the basic aims of science teaching.

3. *Are effective means of communication among all the grades and levels from kindergarten through twelve being used so that all of the science teachers know the content and aims of science, and learning activities for all grades in a school?* Articulation of a good science program should be achieved through several ways of cooperative effort: conferences, meetings, discussions, committee assignments, publications, and reports. Every teacher should know what the science background of his pupils might be at the beginning of the year.

4. *Are the goals of instruction re-examined by the evaluating groups?* Periodically, science teachers should determine whether the stated objectives are realistic and evaluate whether or not such objectives are being developed.

5. *Are series of pre-tests and post-tests in science prepared for several grades at about the same time that a new curriculum is established and taught?* It is very desirable to construct tests that are related to the curriculum and its objectives.

6. *Are evaluation instruments other than tests used to determine development of pupil skills, attitudes, interests and behavior changes?* Many forms of evaluation can be used: conferences, anecdotal records, rating scales, inventories, observations, pupil projects, and special assignments.

7. *Are the personal and social needs of the pupils considered in reconstructing or evaluating a science program?* If a large group of students in a particular high school plans on careers in science, very advanced courses and materials should be made available to them. On the other hand, if the dominant group of students is a non-science group in terms of ability and personal needs, the science curriculum might best be geared to the aims of general education.

8. *What follow-up procedures are employed in evaluating the learning of science?* It is possible that the real worth of a science program may not be appreciated until some time after a student completes a course or leaves school. Are organized attempts to secure information from students made periodically?

9. *Are changes in the content of a science curriculum made at the same time that the goals of science teaching are re-examined?* Scientific research, like evaluation, is a continuous process. Hence, care should be taken that a science curriculum does not develop into an additive outline to which only new discoveries are included in the instructional program. It is important to know what to delete or modify, and changes should be made only after careful consideration is given to the goals of teaching science.