

What are new proposals in science education? in language arts? in mathematics? in the fine arts? in cultural understanding? We are eager to learn of these proposals.

What new approaches are being developed? What new concepts are being conceived in areas once supposed, even by their practitioners, to be quiescent and static? What new sequences of materials and aids are being constructed? What new administrative arrangements of space and time and personnel are being proposed in relation to these more or less traditional areas?

We believe that these new develop-

ments, wrought with such infinite care and devotion by the finest minds of our era, at such great cost in time and money, should be studied carefully and cooperatively by school people. The proposals should be tested scientifically in the practical setting of the school. When and if they are, intelligently and humanely, adapted to the school program, these new advances will help the schools better to achieve their purpose—which is at once the purpose of our democracy—the creation and nurture of freemen, whole and intelligent, in a free world.

—ROBERT R. LEEPER, *Editor*, EDUCATIONAL LEADERSHIP.

Science in the Schools—Some Homework To Be Done

THAT science programs in the schools are greatly in need of change and improvement is scarcely news to anyone these days. Many voices, expert and otherwise, are speaking. Across our land there is widespread ferment and activity aimed at the evolution of an improved program of learning in science for all children and youth. Yet a continuous, developmental K-12 program in science is a long way from being an actuality in many school systems. Some difficult, but essential homework remains to be done in many a school.

An up-to-date, effective program of learning in science in any system does not develop by chance. Definite agreements and plans need to be evolved locally by all those concerned. In some places, adequate communication dealing with the local science program is lacking among the teachers of science in the elementary grades, the junior high schools and the senior high schools. Local cur-

riculum coordinators, directors of instruction, principals, all general curriculum workers at the local level need to use more initiative than they are now showing in some places in facilitating school-wide planning for a program of learning in science for all the children and youth of the community.

The need for reviewing and rethinking the science program in the schools has been sharpened by the urgencies of life in the last half of this century. Social and cultural forces, accelerated in the past decade, have crowded us into this nationwide questioning of the adequacy of the school program in science. Contributing factors include rapid advances in the sciences, the onrush of world events, international competition and tensions, an apparent lack of interest in and understanding of science on the part of many citizens, the renewed interest of scientists in elementary and secondary education and the dissatisfaction of many teachers

with the status quo of the program. Through the years, some schools have developed science programs of high quality and many students have been encouraged, counseled and skillfully instructed by excellent teachers of science. However, it has become increasingly clear that *all* children and youth in *all* the schools do not have the opportunities they deserve to develop the skills of inquiry, research and discovery that have been so rewarding in the sciences and to become truly literate in modern science.

All such concerns have helped to focus attention on the urgent need for interested and knowledgeable scientists, classroom and college science teachers, agencies and institutions to seek out creative and cooperative ways of bringing new light to the task of revising and upgrading science programs in American schools. No stalemate of inactivity was induced by the far-flung criticisms of American schools, especially of their programs in science and mathematics. Responses on the national level, on regional and local levels to the challenge are among the most encouraging developments in modern educational planning and cooperation.

Help Is Available

Large scale experimental projects, national in scope and financed mainly by Federal funds and foundation grants have developed and are continuing to develop invaluable resources for upgrading various aspects of the science program in the schools. The Physical Science Study Committee, the Biological Sciences Curriculum Study, the Chemical Education Materials Study and the Chemical Bond Approach continue to make available creative and fundamental materials. In the setting up of these projects, innovations

in working arrangements have made possible the involvement of scientists, educators and classroom teachers in the development of new curriculum materials, in the experimental tryout in classrooms and in the further refinement of such resources for learning. Notable contributions have been and are being made by these projects to the modernization and revitalization of science courses in the schools. Not only have new learning materials been made available, but in addition basic goals of science teaching are being clarified and the processes of learning in science are being identified. Up to the present time most of these large scale studies have been concerned primarily with science in the high schools. Plans are now afoot at the national level for a comprehensive and intensive consideration of science in the elementary and junior high school grades.

New Approaches

Out of such undertakings many new insights, much new learning material, several new courses are feeding into the main stream of curriculum development in science. Selection and coordination of these resources are needed in local planning for the improvement of the science program. Many schools have teachers who have participated in one of these projects in one way or another. The experience of these teachers should be utilized in improving the local school program.

Other resources are at hand to be drawn upon. Through financial assistance made possible by the National Defense Education Act, local schools can improve materially the supply of tools and equipment for scientific inquiry needed by learners as they participate in quality programs of science. Professional organi-

zations dedicated to the improvement of the science program in the American schools have developed bulletins, pamphlets, yearbooks and articles useful in planning for learning programs of excellence in science. Insightful and competent teachers are sharing their wisdom through writing and speaking.

On the Move

The local teachers are, beyond a doubt, the greatest resource at the local level for continuous development and revision of the science program. Many teachers, elementary, junior high school, secondary, either singly or in teams, have had recent opportunities to learn modern theories and principles of science and to explore improved ways of guiding children and youth learning science. The National Science Foundation, through institute programs in cooperation with colleges and universities, has made it possible for many teachers throughout the United States to upgrade their backgrounds in science. Foundations and industrial companies have made a variety of experiences in science available to teachers. Most school systems have teachers who have participated in courses, in-service workshops, institutes and conferences designed to accelerate improvement of the science program in the local schools. In their classrooms, hundreds of teachers are doing an expert job of providing children with significant and appropriate learning experiences in science. All these teachers constitute a great resource in their local schools. In many places, they need leadership in organizing for the business at hand—that of cooperatively planning and maintaining continuous developmental programs in science from kindergarten through high school in the school system where they work.

This brings us again to the strategic role of the general curriculum workers, supervisors, principals, coordinators of science in a school system. Whether or not Great City, Suburbia, Slum Town, Elm Town, Prairie Town, My Town or Anyone's Town provides a modern, exciting, continuous program in science for all the children and youth thereof will depend in significant measure upon the quality and character of the local leadership for curriculum planning in each school. Some organization is needed for coordinating all the human resources available for improving and enriching the science program in the local system. Many schools are finding that a science coordinating committee with representation from each level of the school can facilitate school wide planning. Helping elementary school teachers, junior and senior high school teachers become an effective working team is no easy task.

Many groups find that bringing together a professional library of recent publications in science and science education is of immeasurable help in planning the science program at the local level. Easy accessibility of forward looking statements, documents, research studies on science in the schools can provide much stimulation and support to members of the local group as they develop the program for their own system. Ideas and the plans of others can be of help in focusing on the problems and issues in the local situation.

Each planning group has the hard task of facing up squarely to becoming informed on research and frontier thinking in the area. Everyone concerned needs to participate in clarifying the goals and objectives to be sought in the program. All need to help spell out how students will be behaving if the goals

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It was suggested that *responsiveness* on the part of the teacher to children's remarks, questions, personal experience (data they place in the situation), would lead them to greater involvement in content (subject matter) and stimulate use of higher mental processes.

Teachers demonstrated different patterns in teaching. Different patterns do affect the learning of children (8, 9).

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Editorial—Homework To Be Done

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are being achieved. Large organizing themes or areas for the K-12 program need to be identified as guide lines around which teaching-learning experiences at the various levels of the school can be developed. Each group needs to consider the adequacy and arrangement of the physical facilities and equipment for fostering desirable learning in science.

Local leaders will need to assist in making plans for ascertaining the effectiveness of the science program. Throughout the span of school years, both teachers and students need to know whether the behaviors and attitudes set forth in

the goals and objectives and encouraged in the learning experiences are being achieved.

Science programs in the schools are on the move. As more and more schools face up to the homework that is before them, the more confident we can be that children and youth everywhere will be involved in learning science that is appropriate and significant for life in modern times.

The articles in this issue explore a number of fundamental considerations that have bearing on the development of programs of excellence in science in the schools.

—ROSE LAMMEL, *Professor of Education, Wayne State University, Detroit, Michigan.*

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