Alexander Frazier and the
Elementary Science Study Staff

What counts in in-service education?

Improving the Elementary Science Program

WHAT approach to the improvement of the elementary school science program makes the most difference? What aspects of program improvement need to be combined to ensure the development of a broadly based science program? What are the values of all the many ways by which school systems have been trying during the past ten years to help teachers find a new place for science experiences in the elementary program?

Such questions as these give rise to the study here described. Like others across the country, school systems in Ohio have been and now are expending large amounts of teacher and supervisory energy and considerable sums of money to upgrade science teaching in the elementary school. But they have little to go by as to what really counts in working for a better program. What has been written about in-service education in elementary science would apply equally well to any other area. For example, the report of a recent conference on elementary school science attempts to answer the question, "What are the most helpful experiences in science for in-service elementary teachers?" This report lists such activities as carefully planned opportunities for observation, carefully planned workshop experiences, consultation with generalists or specialists with advanced training, and the considered use of television.

Such a list applies as well to the improvement in reading or arithmetic. Yet it fails to identify the particular kinds of problems faced in the development of the elementary science program today. Science is a field in which what is worth teaching, how it should be learned, and how much time it should be given are still open questions that have to be worked through with many teachers. As compared with most fields, science is relatively new in the elementary school. Science is a field in which the preparation of elementary teachers varies greatly. Moreover, what teachers have learned about science tends to fall in the category

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How can teachers get at what children already know and what they need to know about science?

of biological sciences rather than to cover the whole field.

The emphasis in many programs of elementary science has been on the descriptive or has dealt largely with collecting, identifying and classifying objects or items found in the immediate environment. Relatively little attention has been given to the experimental approach to learning science. Even when one is well prepared, science is a field in which a great deal of effort is required to keep up with new information and understandings. Culturally, science has been regarded as a man's field, yet most elementary teachers are women.

What this all adds up to is the need to think through as specifically as possible the kinds of experience for teachers that really will make a difference in the development of a more effective science program in the elementary school. New insights into this matter will, of course, throw light on the broader concern for in-service education in all areas, as will be pointed out later in this report. Yet pressing through for greater depth in a given area would seem to be necessary if we are to move beyond generalities in trying to assess program improvement needs and plan specifically for increased teacher competence.

Elementary Science Study

Against this background, 11 Ohio public school systems [1] have joined the Center for School Experimentation of the College of Education, The Ohio State University, in a three-year Elementary Science Study. As a first step in thinking through in more detail the comparative values to be derived from varying kinds of approaches to in-service education, the study staff has defined the following seven activities:

1. *Clarifying the place of science in the total program.* Teachers need to come to grips with the importance of science in the elementary program. Why is science important for children? How does science education relate to other aspects of the elementary program? What kinds of science are most appropriate? How should the science program be organized? How do children learn science?

2. *Extending teacher knowledge of science.* Many teachers need to know more science in terms both of its scope and its process if they are to teach more of it or to teach it more confidently and effectively. What kinds of science information do teachers need? How can they learn it most efficiently? How can teachers be helped to keep up with current science developments?

3. *Learning more about how to teach*

[1] The school systems are Alliance, Brookville (Montgomery County), Mariemont, Martins Ferry, Mount Vernon, Northmont (Montgomery County), River Local (Monroe County), South Western, Struthers, Wayne Township (Montgomery County), and Wooster.

science. Some teachers may feel inadequate in their handling of science because they lack familiarity with methods of experimentation and the like. How can teachers be helped to gain a better understanding of the way children learn science? How can they be helped to become more adept at planning science experiences with children?

4. *Selecting instructional materials for the science program.* Teachers are faced with the problem of making choices from an increasingly varied and ample supply of instructional materials, including textbooks, trade books, films and other audio-visual materials, supplies of many kinds, and a great range of equipment. How can teachers be helped to develop useful criteria for selection? What benefits accrue from being involved in studying and selecting instructional materials? How can teachers best be oriented to the uses of newly supplied materials?

5. *Developing teacher guides for the science program.* Teachers value guides or courses of study as an aid in improving their teaching. What kinds of guides are most useful? How can they be developed so that their values will be greatest? What kinds of help do teacher groups need in developing guides?

6. *Studying children's concepts and needs in science.* Very little is known for sure about how children's science concepts develop. As a result, teachers may sometimes feel that children are more or less able to deal with science concepts than the authorities contend. Also, some teachers may feel their children know more science than they themselves do. How can teachers get at what children already know and what they feel they need to know? What effect will such studies have on science teaching?

7. *Studying the feelings and attitudes of teachers toward science.* Some teachers may need to examine how they feel about science before they are able to do a better job of handling it in the classroom. How do teachers differ in the importance they attach to science and in the level of confidence with which they approach teaching it? What difference may it make if teachers are helped to confront their feelings about science?

Various Approaches

These, then, are major lines that the study is pursuing in an attempt to help establish better programs of in-service education that really dig into the needs of this particular field. Each school system in the study will work during the three years to pursue a variety of these and other approaches with the hope that what happens can be accounted for in terms of what really seems to make the most difference.

Toward this end, the study staff has adapted or devised several instruments that will be used to supplement the records of in-service activity and the personal evaluation by participating teachers. These instruments include one called, "How Do I Feel about Teaching Science?" In an earlier form, this device was used in another study of in-service education. In this study it was found useful in checking the extent to which teachers grew in their confidence in handling physical science content and using the experimental as opposed to the reading-about approach to science teaching.[2] The titles of two new instruments are

[2] Reported in: Alexander Frazier and Lewis D. Evans. *Testing the Effectiveness of Two-Purpose Television Programs in Contributing to Both Teacher and Pupil Learning (Elementary Science).* U.S. Office of Education, Grant No. 7-33-045.00. Columbus, Ohio: The Ohio State University Research Foundation, 1960; mimeographed.

self-explanatory: "What Is a Good Science Program?" and "What Would Help Most To Improve the Science Program?"

The central problem in such a study, as seen by the present reporter, is to become more sharply aware of what it really takes to promote effective program development, in science in particular and consequently in other areas as well. With the heavy emphasis on science today and the accompanying sense of urgency, it may not be surprising that too many efforts to improve the program have been piecemeal and unrelated. The extent to which some school systems may be entrusting the improvement of their programs to the purchase of equipment under the National Defense Education Act is a case in point. As Glenn Blough has said, a good many teachers are being confronted with new equipment which is so unfamiliar they do not know which end to look into. "Standard" lists for easy ordering have been supplied by several sources, interested as well as disinterested.

Personal Involvement Needed

We do need what we need. But for what? And why? And when? Questions of purpose may sometimes get lost in our effort to solve the problem of seeking for quality teaching by working around rather than with teachers.

The same avoidance of the tough task of working together to develop truly meaningful new insights and agreements about the ends of education in the elementary school and how science can best contribute to these ends may also be seen in several other of the more familiar approaches to instructional improvement from which too much may now be expected. If more equipment and a greater flow of supplies will not do the trick, perhaps what we ought to try is a new textbook series. Or perhaps we ought to have the head of the high school science department teach a course in astronomy this spring. Or perhaps we ought to hire someone to come in next summer to update our teaching guide.

All these ventures, if they are planned to involve enough teachers deeply enough in the process of new learning, can, of course, be useful in the improvement of instruction. The question we need to keep before us in science, as elsewhere, is the extent to which we may actively if unknowingly evade getting right down to the kind of personal involvement that results in real professional growth. We need to become more alert to the ways through which we may tend to try to solve our problems institutionally and impersonally, that is, by working on conditions rather than by working with people.

The spotlight falls on ineffective program development in elementary science in part because it is so widely underdeveloped. We do need more and better supplies, equipment and books. We need all the assistance we can get from every possible source.

But if the present study realizes its promise, it may help to determine the extent to which greater professional competence must always come from personal growth. The challenge is that by bringing conditions and commitments into proper relationship, we may be able to affirm more tellingly than ever what we have long contended: Genuine improvement in instruction depends upon the new understandings that make it possible for us to use more fully whatever can be of value in helping children make increasing sense out of their world.