Cecilia J. Lauby

Materials in Science Education

help meet pupils' needs and interests

"MISS Bixby, what is this?" asked Tommy as he put a small glass jar containing a caterpillar into the hand of his kindergarten teacher. "I saw several of them on the sidewalk yesterday afternoon. There were some on the leaves of the shrubbery, too."

In another classroom Mary presented her teacher with a newspaper clipping containing the temperature readings in different parts of the United States. She asked, "Miss Leonard, why do some of those temperature readings have minus signs in front of them?"

"Say, Miss Wood," said John as he came through the classroom door, "yesterday we were studying about the marketing of livestock. Remember? Well, last night Dad said, 'The stock market hit a new high today.' What did he mean?"

Jane walked up to the teacher, who was assembling some materials for the study of distance and time. "Mrs. Opell," said Jane, "last night Mother was helping me look for a timetable. I wanted to get one that would be different from the others. Dad said, 'Jane, why don't you take this timetable of the satellite Echo? It isn't always in the paper because we can't always see Echo.' Mrs. Opell, why can we see the satellite Echo only at certain times? How far away is it?"

If any one of us walked through a school building during any day and stopped to visit several classrooms we would find children asking questions such as these. If we continued our journey and stopped at the principal's office, we probably would hear questions such as the following being discussed: How much science equipment should a school purchase? At what grade level will microscopes be needed? What science instructional materials are needed in the primary grades; in the intermediate grades; in the upper grades? Will all the teachers use the materials if we get them?

These latter questions emphasize the state of flux of the science program in the elementary school. The children's questions give some indication of the wide expanse of science information to which children of this era are exposed.

Impact of Science

All of us are aware of the impact of science on our present-day society. Science is not a subject that is confined to the research centers of colleges, universi-

Cecilia J. Lauby ***is Director, Professional Laboratory Experiences, Illinois State Normal University, Normal.***

ties and industries. Almost every issue of the daily newspaper carries information about science. Television and radio are constantly informing us of new scientific achievements. Children of this generation are surrounded by scientific information. No longer can we ask: should science be an integral part of the educational curriculum at all levels? Society and the events of the times have decided that answer. Now we in the teaching profession must decide how the children and youth of our society can be taught most effectively that science which they need to know in order to enable each pupil to develop to his capacity and to become a worthy, functioning member of our democratic society.

As science becomes an integral part of the curriculum of the elementary school, pupils will enter the secondary school with a much stronger and broader science foundation than formerly. Consequently, the science program of the secondary school will need to be adjusted to fit the needs of these pupils. This will require a re-evaluation of the instructional materials used at the secondary as well as the elementary level.

Specific areas of science have been an important part of the curriculum of the secondary schools for many years. As a result, instructional materials of many and various kinds have been developed for use at the secondary level. However, teachers at this level will need to keep themselves continually informed about the research, advancements and achievements which are being made in their areas of specialization. These teachers must learn what science is being taught at the elementary school level so that they can build on the foundations which have been established and help the young people obtain an increasingly greater understanding of the world of science through the use of the newest scientific instructional materials available.

The task of improving the teaching of science at either the elementary or the secondary level is not as simple as it may appear. As all of us know, worthwhile improvements at any level are not easy to accomplish.

Although some science has always been taught in the elementary schools, for a long time science content centered around the nature-study approach. Then, in keeping with the thinking of the times, attempts were made to teach that science which the children wanted to learn or needed to know in order to understand their environment. Until science found its rightful place in the elementary curriculum, the teaching and learning of science was rather haphazard. All too frequently it was incidental or accidental rather than well planned.

One must also realize the limitations of many elementary teachers with respect to the demands made upon them. Above all else Johnny must learn to read! Then he must learn to write and he must learn his numbers—an area which the mathematics educators are presently studying. Johnny must learn how to get along with his neighbors and to be a contributing member of the group. He must also learn something about his environment. Can you not understand the reasoning of the elementary teacher who asks: "Where can I include some science learnings in the daily program?"

As a result of all this, science in the elementary school has had, for the most part, no systematic approach. Many times children studied the same or similar understandings, concepts or facts in several grades. Some areas of science were never presented because either the teacher was unaware of the repetition,

felt insecure in his ability to teach a particular area of science, or did not find time for it in the daily program.

Realizing this dilemma, science educators set about to improve the teaching of science in the elementary school. Improving the teaching and learning of science in the elementary school, they reasoned, would inevitably affect the teaching and learning of science in the secondary school.

We recognize that we are living in an age that is tremendously influenced by science. We know that we have learned much about how children grow and develop—their needs and interests. We also recognize that there are limits beyond which one cannot expect a teacher in the elementary school to extend—he cannot be a walking encyclopedia having extensive knowledge in all areas of the curriculum as well as child psychology and the psychology of learning. Realizing all this, science educators are attempting to provide the teachers with instructional materials which will help them teach the children and youth of this generation the science understandings that they need.

Study in Depth

In the production of these instructional materials, science educators have organized the content of science so that every child will have an opportunity to learn and understand many, if not all, of the areas of knowledge included in the world of science. A good organization of content not only assures coverage of many, if not all, of the areas of science, but also lessens the amount of repetition to which a child is exposed and confines the repetition to that which is necessary for learning. A good organization of content also gives security to the teacher

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"Feeling" electricity.

because this gives him a clearer understanding of his responsibility. He knows what content he is responsible for and thus can gain proficiency in these areas.

Organization of content, as used here, is not intended to mean that every child in the United States will be studying "energy" on November the 14th at ten o'clock! Organization of content can be achieved through school- or system-wide curriculum studies, through the use of basal science series texts, through the use of courses of study designed for a specific area, through the compilation of resource units. Whatever procedure or combination of procedures is used, it is important that the instructional materials used in a science program be fashioned into a well-developed type of content organization.

It is the belief of many science educators that greater science understandings are achieved when a science area is studied in depth and when fewer science areas are covered in one year. Some of the newer instructional materials have been organized so that science understandings can be taught and learned through the depth or, as some call it, the spiral approach.

Experimentation is a learning device which lends itself more to the teaching

and learning of science than to any other one area of the curriculum. Many instructional materials are available which can be used in experimentation and demonstration activities. However, let us always remember the purpose for which the experimentation or the demonstration is being performed.

In the teaching of science, experiments will and should be used. Experiments, though, should be used when and only when this is the best procedure for teaching and learning the scientific understandings or concepts being developed. Experiments may be performed by one pupil, by a small group of pupils, by several groups of pupils, or by all the pupils. Selection of the procedure will vary according to the purposes which are to be achieved.

In the matter of experiments, it is well for the teacher to remember that the slower the pupil, the more need he has for doing an experiment because of his inability to comprehend abstractions. One of the best ways for him to learn is to learn by doing.

When conducting experiments to develop scientific understanding, it is important that the pupils be involved as much as possible in assembling the equipment. If tin cans are needed, urge pupils to bring some. Keep the equipment being used as simple as possible. Avoid losing sight of the learning objective through getting involved in a maze of equipment. Remember that the purpose of the experiment is to develop understanding. On the other hand, it would seem foolish economy to have a teacher and a class spend hours making equipment which can be purchased commercially. Whether equipment is to be made or purchased should be determined by the educational objectives to be attained.

Some of the new instructional materials such as the teachers editions of some of the new elementary basal science series, give very specific and helpful suggestions to the teacher concerning many kinds of science activities which can be used to help children learn the scientific understandings being studied. These teachers editions also list the materials needed to carry on these activities.

Whatever instructional materials are used, whether books, films, charts, diagrams, models, specimens, slides, transcriptions, television, community resources (including personnel), field trips, observations, observation areas, science displays, demonstrations or experiments, the teaching of science should have specific objectives. These objectives cannot be attained by reading about science. Neither should the study of science be confined solely to a study of the application of scientific principles. Nor should it be a collection of experiments.

The study of science should help pupils acquire an understanding of that body of knowledge which in our culture is labeled "science." It should also enable the pupils to acquire certain skills such as: the ability to observe and report accurately, to compare objects or phenomena with respect to likenesses and differences, to collect data needed to formulate hypotheses, to rank information, to conduct experiments, to formulate conclusions based on sufficient evidence.

It is evident that today many fine instructional materials are available which can be used in the teaching of science. However, there is always the human dimension. No instructional material is better than the use made of it by the teacher who is guiding and directing the learning of the children and youth.