Science in the Elementary School: A Humanistic Approach

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A review of the past decade's literature provides many profound and provocative statements relevant to science teaching in the elementary school. A brief sampling follows.

> "Science is the investigation and interpretation of events in the natural, physical environment and within our bodies."[1]
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> "Science has its importance in elementary education *only* as it serves boys and girls . . . ."[2]
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> "Our highly developed science-oriented and technology-oriented culture is a direct result of observation, search for regularity, and utilization of discovered regularities for prediction about future events; this is what we call modern science."[3]
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> "Our purpose becomes clearer perhaps if we regard science not merely as a body of information about the world but as a way of learning more about the world. If we regard the scientist as a perpetual learner, as indeed he is, then we see a teacher of science to be similarly engaged; and in turn expect no more of the child than is to be found in a child free to seek, free to be curious, free to inquire; that is, we expect persistent learning—with the zest of creativity."[4]
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> "In my opinion—the single, dominant, pervasive commitment to be adumbrated through the warp and woof of any program of science for the elementary school is that science is a human activity—an elusive human activity. And it is an activity in which the correct response or the right answer—if there is one—is the least important aspect of the undertaking."[5]

The quotations could be continued, for we suffer from no lack of eminent and eloquent science educators who have provided us with a rich heritage of published materials. Our problem in elementary science education today is neither the lack of leaders who would lead us to the Promised Land, nor the lack of materials and programs designed to facilitate this movement. It seems to me that the major problem confronting us today is that *it is not happening*. Science in the elementary school for the most part is not the creative human activity previously described in which children zestfully and freely observe, investigate, interpret and control their world. Instead what we see is something quite different—and this is said on the basis of twenty years of professional activities in science education in many different places ranging from the East Coast of the United States—Harlem in New York City, Scarsdale, New York, small communities in Vermont, and in Puerto Rico—across the country through Chicago and Winnetka, Illinois; Berkeley, California, and the islands of Hawaii; in Saipan and Yap—the U.S. Trust Territory of the Pacific; Japan; and most recently in American Samoa. What is happening in elementary science in most places in the United States and elsewhere is much closer to the following two examples than it is to the exciting instances some of us have seen in our Science Curriculum Improvement Study activities.[6]

Example 1: A third grade class in California was beginning its study of science for the year with a consideration of the concept—air is a real substance. The textbooks had been distributed and one youngster was reading aloud while the rest of the class followed along. He reached a section headed *EXPERIMENT* and asked the teacher if he should read that also. The teacher positively responded, "Certainly! Experiments are very important in science!" Thirty heads nodded in

unison and the reader continued. The textbook was profusely illustrated. Questions were raised in the text. These questions were answered in the text either by further reading or by reference to the illustrations. There was no need to do anything but sit and read. In this classroom, the year's work in science had begun. The pattern would vary little from day to day, week to week, unit to unit.

Example 2: A fifth grade class in American Samoa was viewing a science lesson on Instructional Television. The boys and girls were looking at film clips of insects and responding in unison to questions asked by the TV teacher eliciting answers such as "An insect has three body parts," "An insect has six legs," "An insect has three pairs of legs." Instructional television plays the major role in elementary science education in American Samoa and there was no evidence available which indicated that the children moved beyond this rote and wordy approach to science. Three 15-minute telecasts are presented weekly for first and second grades, two 20-minute telecasts weekly for third and fourth grades, and four 20-minute telecasts for fifth through eighth grades.

Other similar, observed examples could be described. These two, however, are quite typical of what happens when science is taught in the elementary school. And while there may be some instances of outstanding science programs, there are many others which do not even match the quality of the examples given.

This article focuses on a humanistic approach to science in the elementary school—an approach in which philosophy, objectives, scope and sequence, and methodology are primarily committed to human interests. In the examples cited the concern seemed to be primarily the information about air and insects. Teachers' responsibility seemed to be to teach the information to the children.

Philosophy For Science Education

In my opinion, philosophical considerations control in large part the kind of science program in which children are involved. These philosophical considerations are closely related to the way in which we view science.

Science is usually conceived as a noun. Within the framework of a noun view of science, teachers teach science to students. They teach information, concepts, principles, etc., from defined areas of research and knowledge. They teach about the scientific method and the applications of science. Science may also, however, be viewed as a verb. Within the framework of a verb conception of science, teachers provide children with opportunities to science. As children science, they observe, interpret, and communicate in a variety of ways. Some of these ways are listed here.

As students observe, they			
look	taste	measure	probe
listen	examine	experiment	test
touch	handle	explore	search
smell	investigate	study	quantify
As students interpret, they			
deduce	theorize	classify	question
induce	predict	group	generalize
discover	postulate	think	explain
create	infer	synthesize	err
accept	invent	validate	hypothesize
reject	compare	evaluate	analyze
As students communicate, they			
discuss	talk	disagree	record data
criticize	write	agree	share ideas

Under the framework of humanistic philosophy for science teaching in the elementary school, children would be involved in doing all of these things as they sciened. Science would be a skill subject rather than a content area. Commitment would be to children and human activity rather than to science and a body of knowledge.

Objectives For Science Education

Objectives for science education should be consistent with and flow directly from the philosophical position described in the previous section. In Figure 1, an overview of human objectives for science education is presented in pictorial fashion. The most prominent item is the child. This is a deliberate attempt to indicate where our allegiance must be. In programs for elementary education, our allegiance must be to children, not to science. We should use science to suit our human ends—the children. We should not use children to perpetuate a body of scientific dogma, principles, basic concepts, big ideas, generalizations, or whatever.

In the illustration, the child is standing above "scientific knowledge." This is knowledge generated by scientists—their concepts, their interpretations of objects and happenings. The objectives for science

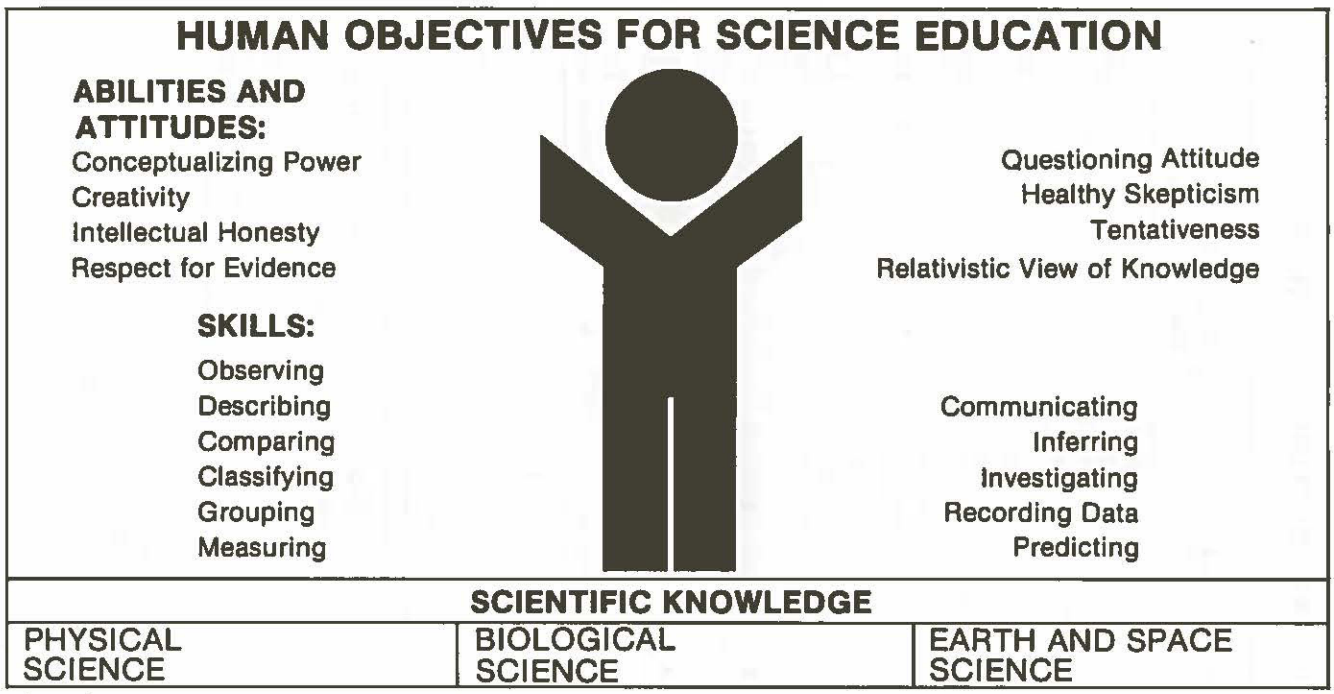


fig. 1

education are shown above the double line. The frameworks in which these objectives can be developed are below the double line. The objectives for science education have to do with children. As children science within the frameworks of science they generate knowledge and we move toward the attainment of human objectives.

In the area surrounding the child in the illustration, two sorts of human objectives are shown. At the highest level are objectives related to intellectual development and certain desirable attitudes and values.

Around the body of the child are behavioral objectives which are usually referred to as science process skills. These skills are part of the verb concept of science previously discussed.

Scope and Sequence for Science Education

Scope and sequence is the framework in which philosophy is implemented and objectives are worked toward. The philosophy and objectives for elementary science described in the two previous sections require a suitable scope and sequence if they are to flourish.

At the present time, in the United States, there are more than fifteen elementary science textbook series in use by elementary school teachers. There are differences among the programs presented by these textbooks. There are, however, many more similarities than there are differences. And the differences in most cases are not overly significant. All of these textbook series would to some degree include science information to be read by or to children. Some of the series would, of course, be more reader oriented than others. All of these series would to some degree encourage the active involvement of children in the science program. Some, more than others. In addition to elementary science textbook series there are many national, state, and local groups projects actively involved in the preparation of elementary science curriculum materials. In general, these materials are more activity oriented than they are reader oriented. In my opinion, it would be fair to summarize the intentions of almost all of these science programs—the commercial textbooks as well as the others—in the following manner:

1. They are concerned with the teaching and learning of science concepts;
2. They are interested in the teaching and learning of science process skills;

ADVENTURES IN SCIENCE

COMMUNICATING—PREDICTING—INFERRING

Primary Focus
■ = Physical
● = Biological
▲ = Earth & Space

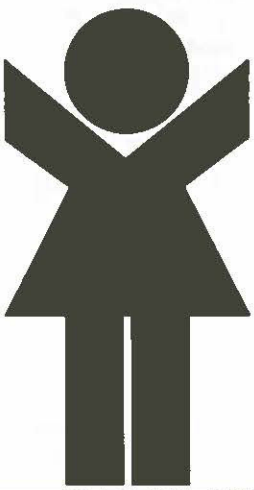
Conceptualizing Power, Creativity, Intellectual Honesty, Respect for Evidence, Questioning Attitude, Healthy Skepticism, Tentativeness, Relativistic View of Knowledge

	Observing, Describing Comparing	Classifying and Grouping	Measuring and Recording Data	Investing Systems of Interaction
Prescience Program	In the pre-First Grade Program there is considerable emphasis on objects from the Physical and Biological Environments. Teachers are encouraged to focus on the development of abilities in each child to describe objects in terms of color, size, shape, texture and other physical properties. The approach taken is consistent with the philosophy of inquiry, and there is active individualized interaction between children and objects in all activities. Many experiences are provided to promote beginning learnings.			
First Grade	▲ Seasons Night and Day	● Physical Characteristics of Organisms	■ Magnetic Strength	■ Light, Color, Shadows
	● Human Senses	▲ Physical Characteristics of the Earth	● Boys & Girls	● Plant and Animal Systems
Second Grade	■ Material Objects	■ Magnetic and non-Magnetic Materials	▲ Clouds & Weather	▲ Air
	■ Solids, Liquids, Gases	● Animal Movement	■ Time & Motion	■ Heat & Temperature
	● Plants: Parts & Growth	▲ Soil	● Body Functions	● Animal Behavior
Third Grade	▲ Earth Environments	■ Floating & Sinking Objects	▲ Earth Temperature	▲ Earth & Water
	▲ The Night Sky	● Taxonomy of Plants & Animals	■● Sound & Hearing	■ Water Cycle Evaporation & Condensation
	● Life Cycles of Organisms & Ecology	▲ Rocks and Rock Cycle	■ Gravity Machines ▲ Force & Friction	■ Earth-Magnet System ▲ Electricity & Magnetism

	■ Physical	● Biological	▲ Earth and Space	■●▲ Integrated
		Observing the Material World		
Fourth Grade	Matter and Change	Life on Earth	-Earth's Changing Surface -Earth History	Oceanography
		Measuring Variations in the Material World		
Fifth Grade	Variation and Measurement	Growth Development and Behavior of Organisms	Weather and Climate	Biogeography
		Interpreting Systems of Interaction		
Sixth Grade	Interactions at a Distance	Interactions Between Organisms and Environments	-Earth, Moon, Sun Systems -The Solar System	Human Problems: Pollution and Conservation

fig. 2.

TEACHING APPROACHES FOR
HUMAN OBJECTIVES IN SCIENCE EDUCATION



Field Trips
TV
Recordings
Bulletin Board Pictures
Study Prints
Charts
Teachers Guides
Teacher Books and Reference Aids

Films
Film Strips
Film Loops
Lab Manuals
Lab Apparatus
Student Text Books
Overhead Transparencies
Supplementary Reading Materials

SCIENTIFIC KNOWLEDGE		
PHYSICAL SCIENCE	BIOLOGICAL SCIENCE	EARTH AND SPACE SCIENCE

fig. 3

3. They are desirous of developing certain behaviors, values, and attitudes in children.

Some programs would primarily be organized in terms of and emphasize the concepts of science. Other programs would be organized more in terms of and have more of an emphasis on the processes of science. All programs would, of course, hope to produce certain desirable behavioral changes in children.

In Figure 2, *Adventures in Science,* scope and sequence for a total multi-media program developed by the author is shown. An attempt has been made to structure the program in a humanistic fashion consistent with the philosophy and objectives previously discussed. High level human objectives are the basis for the total program. They are shown in the second vertical column running from the prescience program through the sixth grade. The rationale here is that one does not take items such as creativity, intellectual honesty, tentativeness, and healthy skepticism, and say, "We will teach one of these at the first grade level, another at the second grade level, and then at the third grade level we will teach the children to be creative." Rather, concerted efforts promoted by a range of instructional materials must be made at each grade level regarding all of these behavioral objectives. The remaining four vertical columns structure the program up to the third grade in terms of science process skills and from grades four through six in terms of discipline areas.

Science process skills are not developed in a vacuum. From kindergarten through third grade, there is a balance of physical, biological, and earth-space environments presented. There is at each grade level, however, an in-depth focus on the development of all the human attitudes, values, and skills shown. The various science areas are used because they provide children with many opportunities to science. Children are not used to perpetuate information from any of these areas.

In the primary program, the emphasis is on process skills and other behavioral objectives. This emphasis does not change as we move from the third grade program into the fourth grade program. The organization, however, does change. Instead of twelve areas of focus

as in the first and second grades, or the eight areas shown for the third grade, sciencing now occurs within the framework of four major units. This in-depth focus on a physical science, a biological science, an earth-space, and an integrated science unit during each year continues the practice of providing boys and girls with many opportunities to observe, describe, compare, classify, group, make measurements, record data, investigate systems of interaction, predict, infer, and communicate.

Methodology for Science Education

Methodology for a humanistically oriented science education program should be consistent with and flow directly from the philosophy and objectives previously discussed. Many different, yet related, teaching approaches can be used. An overview of sixteen methodological items is shown in Figure 3, *Teaching Approaches for Human Objectives in Science Education.* In the illustration the most prominent item once again is the child. This time, however, instead of a little boy there is a little girl—science education must be for all children, boys and girls. In addition, the allegiance to a humanistic approach to science in the elementary school is reaffirmed in this illustration.

Earlier it was stated that we should use science to suit our human ends—the children—rather than using children to perpetuate any body of scientific dogma. The same is true for teaching approach. We should use teaching approaches to suit our human ends—the children — rather than using children to perpetuate any teaching approach, device, or technique. Sixteen teaching approaches are suggested in the illustration. There are others. It should be especially noted, however, that TV is just one of those which are listed. The same is true for student textbooks. In the two examples cited in the beginning of this article, an observer might be correct in assuming that children were being used to perpetuate in Example 1, the textbook and in Example 2, the TV system.

BIBLIOGRAPHY AND FOOTNOTES

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