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James P. Hale
University of Iowa

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Science Education in the Elementary School: A Modern In-Service Offering

JAMES P. HALE
Science Education Center
The University of Iowa

In the past two years at The University of Iowa, we have developed an offering in science education for in-service elementary teachers which provides the elementary school teacher with both an empathy for science and some security with the process-oriented technique. Dean Halverson, in his article entitled, "The Role of Science in the Elementary School" (*ISTJ*, Feb. 1970), stated that few elementary teachers venture back to the university campus to improve their science background because the university "lecture-memorization type" offerings only tend to alienate them more from science. Mr. Halverson goes on to say that, to improve science instruction in the elementary classroom, teachers must move away from fact-oriented science instruction and towards process-oriented science instruction. The question then arises, how does the university provide course offerings which will not alienate teachers, while providing teachers with the capabilities to use the process-oriented techniques in teaching science in the elementary school? Following is a summary of the rationale, objectives and course description of this very successful and exciting in-service course offering which is a positive attempt to respond to this question.

Rationale

The typical elementary school teacher spends her day with 25 to 35 children trying to teach reading, social studies, mathematics, science and other disciplines. It is impossible to comprehend, first of all, how she does it, and, more importantly, where she has gained the subject matter competencies in each of these areas. The truth is that she does not have and cannot be expected to have subject matter competency comparable to that of a secondary or college instructor in each of these fields. In addition, most elementary teachers work under a preparation time handicap and perhaps a one dollar per student per year budget for science materials. With this in mind, the only feasible way to approach in-service elementary science instruction is to assume that the teacher has a "common sense" knowledge of science, a love for children and a willingness to be an active participant in her own learning. These are the three minimal entering competencies for admittance to the course.

General Objectives

In order to provide an experience that will be meaningful, and therefore exemplify the "teach as you are taught" concept, the in-service course is designed: (1) to provide the philosophy and the rationale for each of the primary elementary science programs, ESS, SCIS and SAPA; (2) to provide an in-depth study of and a participation in the "open-classroom" concept of education; (3) to provide an in-depth study of and experiences with the *Environmental Studies* materials, ultimately to promote a cohesive elementary science program which considers the processes of science along with the modern contemporary issues of society; and (4) to relate Piaget-like research to the concepts of evaluation, counseling and instruction.

Philosophy of the Course

Each of the four general objectives previously stated would be accomplished during the semester. Following is a general description of how each of these objectives would be accomplished:

Objectives I and II.

It is our intention to present a minimum of nine activities, three representing each of the three major curriculum projects. Hopefully, this will provide an in-depth view of the philosophy of these curriculum projects. At the same time the students will be working individually with their choice of 20 activities that are available at the activity center of the classroom. Activities representing each of the three curriculum projects and the free-choice activities are listed below:

ESS

1. Mystery Powders (Gr. 3 & 4)
2. Where is the Moon? (Gr. 3-7)
3. Behavior of Mealworms (Gr. 4-8)

SCIS

1. Material Objects (lower grades)
2. Life Cycles (middle grades)
3. Systems & Subsystems (upper grades)

SAPA

1. Classifying (low level)
2. Using Space/Time Relations (low level)
3. Formulating hypotheses (high level)

Free Choice Activities*

- | | |
|----------------------------------|-------------------------------|
| 1. Tangrams (K-Adult) | 6. Pond Water (4-Adult) |
| 2. Primary Balancing (K-Adult) | 7. Senior Balancing (4-Adult) |
| 3. Geo Blocks (K-Adult) | 8. Brine Shrimp (1-Adult) |
| 4. Batteries and Bulbs (4-Adult) | 9. Bones (4-Adult) |
| 5. Clay Boats (2-Adults) | 10. Pendulums (4-Adult) |

- | | |
|---------------------------------|----------------------------------|
| 11. Colored Solutions (3-Adult) | 16. Kitchen Physics (5-Adult) |
| 12. Ice Cubes (3-Adult) | 17. Gases and "Airs" (5-Adult) |
| 13. Attribute Games (K-Adult) | 18. Microgardening (4-Adult) |
| 14. Structures (2-Adult) | 19. Area and Perimeter (3-Adult) |
| 15. Mobiles (2-Adult) | 20. Optics (4-Adult) |

**Each of these activities to be set up at the activity center, with appropriate "open activity" instructions (e.g.: Find out what you can about this set of materials.)*

Objectives III and IV.

At the beginning of every other class session an assignment will be given from the Environmental Studies materials to be completed by the following class session. Following are listed a few of the E.S. activities that will be used.

- | | |
|---------------------|------------|
| 1. Cause and effect | 4. Change |
| 2. Footprints | 5. Million |
| 3. Treasure Hunt | 6. Others |

The first half hour of these class sessions, following the assignment, will be given to treatment of the problem by the individual class participants, followed by a "How to implement in my classroom" discussion.

At the beginning of the alternate class sessions, topical reading assignments will be made. Books or articles by such noted writers as Holt, Kohl, Silberman and Piaget will be included, to stimulate the students' thinking towards the "open-classroom" concept of elementary education. Small group discussions will be the rule, to provide the best possible avenue for exchange of ideas.

Objective V.

Finally, each class member will be required to administer Piaget type tasks to children from K-6. This is done to provide some insight into the reasoning ability of children and to give the class members some indication of the appropriateness of many of the science activities present in our science curricula. The student will collect his data, compile it and draw some tentative conclusions as to its value in instruction, evaluation and counseling.

Tentative Schedule

- | | |
|-----------------|--|
| 7:00- 7:30 P.M. | a. Reading assignment and discussion of E.S. activity (or on alternate weeks). |
| | b. E.S. assignment and small group discussions of assigned readings. |
| 7:30- 9:00 P.M. | "Open classroom" free choice activities |
| 9:00-10:00 P.M. | Presentation of ESS, SCIS or SAPA activity |

For further information about the four curriculum projects mentioned in this article write:

Elementary Science Study
Webster Division
McGraw-Hill Book Company
Manchester Road
Manchester, Missouri 63011

Science Curriculum Improvement Study
Lawrence Hall of Science
University of California
Berkeley, Calif. 94720

Science—A Progress Approach
Xerox Educational Group
4009 Cambridge
Des Moines, Iowa 50313

Environmental Studies
Box 2559
Boulder, Colorado 80302

Today there is much talk about the open-classroom as the educational panacea of the future. Also the writings of John Holt, Herb Kohl, A. S. Neill, Charles Silberman and others are receiving widespread acclaim, lending impetus to curriculum reform in the United States. In order to lessen the shock of this radical change on the individual classroom teachers, the universities and the other teacher training institutions must provide pre-service and in-service course offerings which express this trend. Our course described above is neither the final answer nor the only alternative, but it is an honest attempt to provide the in-service teacher with some positive feeling for her future role in teaching science in the elementary school.

Cleaner Air Ahead?

Environmental Protection Agency Administrator Ruckelshaus has announced that a prototype engine developed by EPA and the U.S. Army has met EPA's 1976 emission standards in initial tests. EPA, the Army, Ford Motor Co. and Texaco, Inc. have been working on the project for the past two years as part of President Nixon's program to develop a virtually pollution free automobile engine.

The new engine, a stratified charge engine, which uses 91-octane unleaded gasoline and features exhaust-gas recirculation and a catalytic muffler,

still has to go through 50,000-mile durability tests.

EPA is charged under the Clean Air Act with responsibility for regulating emissions from new motor vehicles. The law provides for 90 percent reduction of the hydrocarbon, carbon monoxide and nitrogen levels.

The Iowa Science Teachers' Journal is now being mailed to all High School Libraries in Iowa. This service is being provided by the Iowa Academy of Science.