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The Iowa AEA Middle School Science Project - Sleds

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THE IOWA AEA MIDDLE SCHOOL SCIENCE PROJECT

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A resource of over 300 science activities is now available to Iowa science teachers from the Iowa AEA Middle School Science Project electronic bulletin board. It is the result of a report from a 1984 task force commissioned by the Iowa Department of Education to assess the needs of science education in Iowa. The task force identified the grades four through nine as those with the greatest need. Specifically identified was a need for user-friendly teaching materials that emphasized a "hands-on/minds-on" approach to science. Too large a portion of the science taught in these grades was based primarily on a text book, the task force believed. A corresponding specific need was for teacher inservice emphasizing the "hands-on/minds-on" approach to science teaching. In addition, the task force identified a need to include more emphasis on technology in the science program.

The response of the Department of Education was to ask George Magrane (Southern Prairie AEA, Ottumwa) and Dean Hartman (Grant Wood AEA, Cedar Rapids) to develop a project that would address these needs. Initially known as the *Iowa 4-9 Science Project,* it coupled an appropriate teacher workshops program with ongoing support for teachers in these grades. The teaching/learning strategy selected was the learning cycle developed by the Lawrence Hall of Science as the basis of the elementary science program Science Curriculum Improvement Project (SCIS) and later adapted by the Iowa projects OUTLOOK and PRISMS. The three components of the learning cycle as adapted by the *Iowa 4-9 Science Project* were exploration, concept development and application.

Twelve Iowa teachers who had demonstrated a commitment to the form of science teaching to be supported by the project were selected as writers. Later, other Iowa teachers were added as authors. These teachers wrote and piloted a large number of activities incorporating the learning cycle along with a "hands-on/minds-on" approach to science teaching. The activities are referred to as "cycles" (see the example following). Through workshops conducted statewide by the project staff, teachers were introduced to the project and invited to test the cycles being developed. These cycles were made available to Iowa teachers through an electronic bulletin board accessible by a computer and modem from any school in the state. The project bulletin board currently contains over 300 cycles covering all areas of science, with additions being made periodically. Because the current curriculum is

skewed toward the life sciences, especially in the elementary grades, greater emphasis has been placed on the development of physical science cycles. Some activities have been written specifically for use with academically talented students.

Funding for the project was initially provided by the Iowa Department of Education from legislative funds and federal Educational Economic Security Act funds. During the past three years, the project (now known as the *Iowa AEA Middle School Science Project*) has been funded by a National Science Foundation grant along with support from the Area Education Agencies of Iowa. This funding has provided a six-week summer workshop for approximately 90 Iowa teachers who teach science in one or more grades four through nine. The workshops included instruction in all science fields by university/college professors, together with instruction in the project teaching/learning strategies and other science education issues provided by the project staff. Two follow-up sessions were held during the academic year. Workshops throughout the state have made the program available to other teachers.

The project staff will, as funds are available, continue to provide support to Iowa teachers by adding activities to the bulletin board and offering teacher workshops. If you would like to have access to the *Iowa AEA Middle School Science Project* electronic bulletin board, contact your Area Education Agency Educational Services Division regarding the scheduling of a workshop in your area. At the workshop, participants will learn to access the bulletin board as well as to use the learning cycle. You may also contact the project directors at the Grant Wood Area Education Agency, 4401 Sixth Street, SW, Cedar Rapids, IA 52404, ph. 1-800-332-8488.

The following is an example of a cycle from the *Iowa AEA Middle School Science Project*:

SLEDS

by Rollin Bannow, Science Teacher
Grades: 7-9

Concept Objective:
The concept is the set of forces acting on balloon-powered sleds.

Process Objective:
Thinking skills developed are predicting and investigating.

Materials (per student):
--several balloons
--12" x 18" sheet oak tag
--masking tape

Exploration:

Provide each student (or group of students) with a balloon, sheet of oak tag and access to a supply of masking tape. Instruct the students to construct a sled which will travel in a straight line. As the students become successful, encourage them to improve their designs to increase the distance their sleds will travel. During the building and testing, encourage them to analyze their vehicles by asking questions such as the following:

-- How does the amount of air in the balloon affect the distance that your vehicle travels?
-- What factors are keeping your sled from continuing to travel forever?
-- How can you partially overcome those factors?
-- If you would change __X__ (some facet of the vehicle that you observe), how would the vehicle's motion be affected?

Concept Development:

When the students have had sufficient time to build and test their vehicles, hold a contest to determine which designs can travel the greatest distance in a straight line. To help in the measuring, several tables may be placed end to end to create a fairly narrow test pad. The distance travelled can then be measured from the starting point to where the sled falls off the table. Video taping the contest can resolve disputes as well as aid in the analysis of design effectiveness.

Students should keep a record of the distances and compute averages of the trials (three trials work well) for each vehicle. When the results are ranked, engage the students in a discussion of why the various vehicles placed as they did. This is a good time to introduce a number of vocabulary words, such as: mass, weight, drag, friction, lubrications, force, power, acceleration, inertia and aerodynamics. Newton's Laws of Motion can also be introduced here if desired.

Application:

1. Using pictures of various racing vehicles, challenge the students to determine how the designers of the pictured vehicles dealt with the various problems that they encountered with their sleds.

2. Have the students build wheeled balloon-powered vehicles for a contest similar to that held for the sleds.

3. If the students build wheeled vehicles, have them design other means of powering them (mouse traps make interesting power plants).

4. Using pictures of airplanes, have the students compare how airplane designers have dealt with the forces of motion and Newton's Laws.

5. Have the students construct paper or balsa wood plane models utilizing the knowledge they have gained about forces.