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Energy Concepts in the Iowa School Curriculum

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ENERGY CONCEPTS IN THE IOWA SCHOOL CURRICULUM

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A National Problem

Public school energy costs have soared nationally 150 percent since 1972-73. According to Educational Facilities Laboratories (EFL), that represented a $50 expenditure per student during the 1977-78 academic year (1). "School energy costs have doubled in the past 5 years. . . . Districts surveyed reported hikes ranging from 35 percent to over 400 percent, the average being 110 percent." (2)

It appears that Americans do not yet believe that there is a serious energy problem, despite exhortations of the President and the effects of the Arab oil embargo. Schools should be a part of a general information program to clarify the problem, explain government programs, and identify the impact of both on schools, students and teachers (3). From a 1975 National Assessment of Educational Progress (NAEP) study concerning energy questions, it was apparent that most students' knowledge of energy concepts is declining at a time when the reverse should be true (4).

The present science curriculum provides many places to insert energy education concepts. However, it appears that it is time for a systematic integration of energy education into the K-12 curriculum. David Kuhn (5) stated that regardless of the model, certain elements should characterize any education program.

1. Energy Education should be interdisciplinary.
2. Energy Education should relate to the everyday life of students.
3. Energy Education should consider attitudes, values and decision making.
4. Energy Education should be future oriented and stress alternatives.

Iowa
Energy Conservation Activity Packets (ECAP's)

In Iowa, efforts are being made to improve energy education for grades K-12. In 1977, the Iowa Department of Public Instruction (DPI) in conjunction with the Iowa Energy Policy Council (IEPC) developed the Energy Conservation Activity Packets (ECAPs). ECAPs contain a variety of interdisciplinary activities, accompanying worksheets,

visuals and annotated children and teacher bibliographies for grades K-6. It correlates energy and environmental education. The materials are housed in separate three-ring binders according to grade level. ECAPs are unique in that they were designed to aid teachers in encouraging development of a conservation ethic within students while simultaneously clarifying student values. Since values tend to reflect how individuals utilize time and energy, the process of values clarification can lead students from confusion, or apathy, to becoming concerned, positive, purposeful citizens of tomorrow.

Mankato State University Energy Program

The Iowa Department of Public Instruction and the Iowa Energy Policy Council would like to extend energy education beyond grade 6 to include grades 7-12. In June 1978, Mankato State University conducted an energy workshop entitled *A Classroom Project: Energy Efficiency of School Buildings*. The workshop was sponsored by the U.S. Office of Energy and served two purposes:

1. Acquaint teachers with some classroom projects for students.
2. Give teachers an extended classroom project to be completed by February 1979 in which students thoroughly evaluate the energy consumption of their school.

Forty high school science and/or math teachers from Minnesota, North Dakota, South Dakota, Wisconsin and Iowa were selected for the 5-day program.

Beginning in the fall of 1978, the 13 Iowa teachers will introduce their students to the concepts and processes of assessing the energy consumption of their buildings. After gathering data and evaluating the problem, students will seek solutions to the problem and/or suggest improvements.

DPI Energy Assessment

In the spring of 1978, the Iowa DPI attempted to assess the present energy programs and perceived energy needs of 700 secondary Iowa social studies, science, industrial arts, and home economics teachers. Three hundred fifty forms were completed and returned (Fig. 1). In addition, the energy status and needs of schools were compiled by school district size. (Size (1) up to 500; (2) 500-749; (3) 750-999; (4) 1000-1499; (5) 1500-1999; (6) 2000-2999; (7) 3000+.)

From Table 1 it can be seen that the dominant concerns of the teachers surveyed were in the areas of (1) Energy Conversion and (2) Political/Social Aspects of Energy Problems. Although there were some inconsistencies by discipline and school district size, the amount of agreement was significant. (Tables 2, 3)

Fig. 1.

DPI Energy Assessment Form

A. Please circle your major teaching area:

Home Economics Science Industrial Arts Social Studies

B. In the left column please indicate availability of materials in your present energy program for each item using the rating scale. In the right column indicate your perceived energy program material needs for each item

Rating Scale

1	2	3	4	5
None	Very Little	Some	Quite a Bit	A Great Deal

Avail. *Needs*

1. *Basic Energy Concepts*
   - _____ _____ *a. Energy forms (kinds of energy)*
   - _____ _____ *b. Energy uses*
2. *The Energy System*
   - _____ _____ *a. Energy flow*
   - _____ _____ *b. Energy demand*
   - _____ _____ *c. Present supplies*
   - _____ _____ *d. Distribution*
   - _____ _____ *e. Future systems*
3. *Energy Conversion*
   - _____ _____ *a. Solar technology*
   - _____ _____ *b. Nuclear technology*
   - _____ _____ *c. Research and development technology*
   - _____ _____ *d. Fossil fuel technology*
   - _____ _____ *d. Fossil fuel technology*
   - _____ _____ *e. Bio-energy technology*
   - _____ _____ *f. Hydrocarbon technology*
   - _____ _____ *g. Wind*
   - _____ _____ *h. Geothermal*
   - _____ _____ *i. Tidal forces*
   - _____ _____ *j. Wave action*
   - _____ _____ *k. Ocean temperature gradient*
   - _____ _____ *l. Other energy sources*
4. *Energy Conservation Areas*
   - _____ _____ *a. Residential*
   - _____ _____ *b. Transportation*
   - _____ _____ *c. Industrial*
   - _____ _____ *d. Institutional (school-hospital-etc.)*
   - _____ _____ *e. Commercial*
5. *Political/Social Aspects of Energy Problems*
   - _____ _____ *a. Value decisions*
   - _____ _____ *b. Trade offs*
   - _____ _____ *c. Energy legislation*
   - _____ _____ *d. Life-styles*
   - _____ _____ *e. Conservation practices*

Fig. 1 (Cont.)

C. Please rate each of the types of educational resources according to how you feel they meet your needs.

Rating Scale

1	2	3	4	5
None	Very Little	Some	Quite a Bit	A Great Deal

1. *Educational Resources*
   - _____ a. *Textbooks*
   - _____ b. *Films and other audio visual materials*
   - _____ c. *Public television programming*
   - _____ d. *Department of Energy publications*
   - _____ e. *Commercial kits*
   - _____ f. *Case studies*
   - _____ g. *Laboratory experiments*
   - _____ h. *Newspapers*
   - _____ i. *Public utility pamphlets*
   - _____ j. *Library materials*
   - _____ k. *University developed programs*
   - _____ l. *Energy units from sources not listed above*
   - _____ m. *Other*
2. *Please name one or two energy resources that you consider most useful.*

D. Please rate each of the supplementary materials items as to the desirability of their format.

1. *Written Materials*
   - _____ a. *Concept-objectives-activities guide*
   - _____ b. *Publisher materials*
   - _____ c. *Case studies*
   - _____ d. *Other (Please specify)*
2. *Audiovisual materials*
   - _____ a. *Films*
   - _____ b. *Film loops*
   - _____ c. *Filmstrips*
   - _____ d. *Transparencies*
   - _____ e. *Cassette tapes*
   - _____ f. *Other (Please specify)*
3. *Inservice*
   - _____ a. *Summer program*
   - _____ b. *Academic year*
   - _____ c. *University/DPI short course*
   - _____ d. *Other (Please specify)*

E. Please share any additional comments you may have regarding your energy program needs.

F. Please return questionnaire to: Jack A. Gerlovich, Curriculum Division, Department of Public Instruction, Grimes State Office Building, Des Moines, Iowa 50319.

Table 1

Dominant Energy Concerns of Secondary Social Studies, Science, Industrial Arts, Home Economics Teachers Surveyed (Composite).

Item	Availability of present materials	Needs	Valid Cases	N-A
Energy Conversion				
Solar	*2.329*	*3.695*	*248*	*1.399*
R & D	*1.996*	*3.350*	*238*	*1.374*
Bio Energy	*1.815*	*3.221*	*239*	*1.431*
Tidal	*1.748*	*3.040*	*240*	*1.317*
Ocean Thermal Gradient	*1.650*	*2.946*	*236*	*1.305*
Political/Social Aspects of Energy Problems				
Value Decisions	*2.245*	*3.642*	*237*	*1.414*
Trade-offs	*1.950*	*3.280*	*228*	*1.346*
Energy Legislation	*2.133*	*3.461*	*236*	*1.322*
Life-styles	*2.305*	*3.667*	*237*	*1.388*

Table 2

Dominant Energy Concerns by Discipline
(Rank Ordered by Category)

Item	Science	Home Economics	Industrial Arts	Social Studies
Energy Systems				
Distribution	*2*	*	*	*
Future Systems	*1*	*1*	*1*	*1*
Energy Conversion Technology				
Solar	*8*	*1*	*3*	*4*
Nuclear	*10*	*	*	*10*
R & D	*3*	*2*	*2*	*5*
Fossil Fuel	*11*	*	*	*
Bio Energy	*1*	*	*1*	*8*
Hydrocarbon fuel	*9*	*	*	*9*
Wind	*4*	*	*4*	*7*
Geothermal	*7*	*	*	*6*
Tidal	*5*	*	*	*1*
Wave Action	*6*	*	*5*	*2*
Ocean Thermal Gradient	*2*	*	*	*3*
Energy Conservation Areas				
Residential	*5*	*1*	*3*	*2*
Transportation	*4*	*2*	*2*	*5*
Industrial	*1*	*	*1*	*4*
Institutional	*3*	*	*	*1*
Commercial	*2*	*	*	*3*
Political/Social Aspects of Energy Problems				
Value Decisions	*2*	*1*	*1*	*4*
Trade-offs	*4*	*4*	*4*	*2*
Energy Legislation	*3*	*5*	*3*	*1*
Life-styles	*1*	*3*	*2*	*3*
Conservation Practices	*5*	*2*	*	*5*

**Not a significant concern within this discipline.*

Table 3

Educational Resource Effectiveness by Discipline

Item	Science	Home Economics	Industrial Arts	Social Studies
Books	5	*	2	5
A-V	1	1	1	2
Public T.V.	4	*	*	3
Lab Experiments	*	*	3	*
Newspapers	2	2	*	1
Library Materials	3	*	*	4
Written Materials				
Concept, Objective, Activities Guide	1	*	*	*
Publishers Materials	2	*	*	*
A-V Materials Format				
Films	1	1	1	1
Filmstrips	2	2	*	2
Transparencies	*	4	2	*
Cassette Tapes	*	3	*	*
Inservice Format				
Summer Programs	2	*	*	*
University/DPI Short Course	1	*	*	*

**Not a significant concern within this discipline.*

Regardless of subject matter or school district size, most teachers surveyed felt that the most effective resources for teaching energy concepts were audiovisual aids, newspapers, and library materials. The dominant written materials format preferred was the concept, objective, activities guides. ALL school districts except Size 5 and 7 also preferred concept, objective, activities guide as the dominant format. In the area of A-V materials format, films were unanimously preferred by all disciplines and school district sizes. Filmstrips were second choice in most disciplines and school districts regardless of size. In the area of inservice format, university/DPI short courses and summer programs were dominant both by discipline composite and school district size.

Iowa Energy Policy Council

In September 1978, the Iowa EPC awarded a one-year, $20,000 grant to the University of Iowa (Dr. Doris Simonis — Principal consultant). An advisory committee composed of secondary science, industrial arts, home economics, and social studies teachers, AEA consultant, DPI consultant, EPC advisor, and the University of Iowa principal consultant has been appointed. Information from the DPI energy assessment may provide assistance in the development of some practical, effective energy materials.

Teachers who have already developed classroom activities centered on energy concerns, and who would like to share them with other

teachers may send them to Dr. Doris Simonis, Science Education Center, University of Iowa, Iowa City, Iowa 52242.

Summary

Energy education is challenging. It is the hope of the Iowa DPI that articulated energy materials can be developed that will be reflective of the identified needs and also complementary to the K-6 ECAP materials.

> "By helping young people understand the possible results of the forces at work in today's world, by having them consider the range of consequences of today's actions, by allowing them to examine the possible outcomes of today's attitudes and beliefs, by confronting them with difficult but necessary choices we help them not only to envision what tomorrow might be, but also to understand how they can participate in creating the best of all possible tomorrows." (6)

If you feel you would like to receive copies of the DPI energy assessment survey to utilize in applying for federal or other state grants, please contact Dr. Jack A. Gerlovich, Science Consultant, Iowa Department of Public Instruction, Grimes State Office Building, Des Moines, Iowa 50319, phone: (515) 281-3249.

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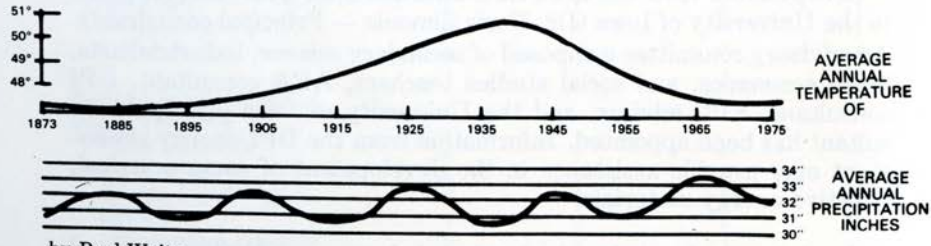

by Paul Waite.

Iowa's climatology history began in 1873.