This life science guide is one of a series of guides, K-12, that were developed by teachers to help introduce environmental education into the total curriculum. The materials contained in the guide are supplementary, and designed to aid the science teacher in providing the kinds of experiences needed by students to gain an understanding of the environmental life processes. The guide contains a series of episodes (minilessons) that are built around 12 major environmental concepts that form a framework for each grade or subject area, as well as for the entire K-12 program. Although the same concepts are used throughout the K-12 program, emphasis is placed on different aspects of each concept at different grade levels or subject areas. This guide focuses on aspects such as succession, ecosystems, and the food chain. Most of the 12 concepts are covered in one of the episodes contained in the guide. Further, each episode offers subject area integration, subject area activities, interdisciplinary activities, cognitive and affective behavioral objectives, and suggested references and resource materials useful to teachers and students. (Author/TK)
LIFE SCIENCE

ENVIRONMENTAL EDUCATION

GUIDE
In 1969, the First Environmental Quality Education Act was proposed in the United States Congress. At the time of the introduction of that legislation, I stated:

"There is a dire need to improve the understanding by Americans of the ominous deterioration of the Nation's environment and the increasing threat of irreversible ecological catastrophe. We must all become stewards for the preservation of life on our resource-deficient planet."

In the three years since the Environmental Education Act was passed by the Congress, much has happened in the United States to reinforce the great need for effective environmental education for the Nation's young people. The intensive concern over adequate energy resources, the economic costs of the war against pollution, and the discussion over the continuing degradation of our air and water, and the catastrophic costs of the war have all brought the question of the environmental quality of this nation to a concern not merely of aesthetics but of the survival of the human race.

The intense interest by the public in the quality of our lives as affected by the environment clearly indicates that we cannot just use incentives and prescriptions to industry and other sources of pollution and stress. The race between education and catastrophe can be won by education and science, but not sufficiently. The sources of pollution and other threats to industry and other areas are affected by the environment in a systematic manner and adequately when it is marshalled our resources to control the long-term approach to our environment through the process of education. The race between education and catastrophe can be won by education and science, but not sufficiently. That is the lesson of the American experience. We must now work diligently to implement the environmental quality of this nation's environment and the attainment of the continuous protection of the environment, not just the temporary stabilization. The passage by the Congress of the Environmental Education Act was a pre-requisite to the continued presence of life on this planet. The intense interest by the public in the quality of our lives as affected by the environment is becoming more and more substantial. The intense concern over adequate energy resources, the economic costs of the war against pollution, and the discussion over the continuing degradation of our air and water, and the catastrophic costs of the war have all brought the question of the environmental quality of this nation to a concern not merely of aesthetics but of the survival of the human race.

Efforts to achieve progress from many of our ill-conceived concepts are feeling the backlash. The intense interest by the public in the quality of our lives as affected by the environment clearly indicates that we cannot just use incentives and prescriptions to industry and other sources of pollution and stress. That is necessary, but not sufficient. The sources of pollution and other threats to industry and other areas are affected by the environment in a systematic manner and adequately when it is marshalled our resources to control the long-term approach to our environment through the process of education. The intense interest by the public in the quality of our lives as affected by the environment is becoming more and more substantial. The intense concern over adequate energy resources, the economic costs of the war against pollution, and the discussion over the continuing degradation of our air and water, and the catastrophic costs of the war have all brought the question of the environmental quality of this nation to a concern not merely of aesthetics but of the survival of the human race.

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If students are to become aware of the living environment around them they must become involved with it. Children of this age level seem to learn best by getting involved with activities that allow them to make observations, collect data, interpret results and draw conclusions. An example of the types of materials can be seen in the development of Concept #2: A unit on succession does this very well by involving the students in constructing several aquatic environments. The students gain an understanding of the life processes and their interrelationships and implications on the environment.

The concepts which have been selected deal with the basic interactions of the life processes, and their implications needed by students to gain an understanding of the life processes. In providing the kinds of experiences needed by students to learn best by getting involved with activities that allow them to make observations, collect data, interpret results and draw conclusions, they must become involved with it. Children of this age level seem to learn best by getting involved with activities that allow them to make observations, collect data, interpret results and draw conclusions. If students are to become aware of the living environment around them...
ACKNOWLEDGEMENT

The interest and dedicated effort of the following teachers from Wisconsin Area "B" has led to the development of the Project I-C-E Environmental Education K-12 series:

D. C. Aderhold, Bonduel
Joan Alioto, Denmark
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Walter Anderson, Wausaukee
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William Eaggs, Shiocton
Anthony Balistreri, Howard-Suamico
Lowell Baltz, Weyauwega
Avid Bartz, Sturgeon Bay
Bonnie Bean, Coleman
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Appl.
Behring, Lourdes, Oshkosh
David Betl, Neenah
Marie B.,
Lonsene Benter, Gillett
Lillian Berges, Seymour
Laura Berken, Green Bay
DePere
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WillarH
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John Cowling, Niagara
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Sara Curtis, Green Bay
Nicholas Dal Santo, Pembine
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John DeWan, Green Bay
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Dennis Dobrzenski, White Lake
Darwin Eastman, Appleton
Linda Eiting, Appleton
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Phyllis Ellefson, Wash. Island
Raymond Emerich, Hortonville
Mike Ercegovac, Winneconne
Gery Farrell, Menasha
Keith Fawcett, DePere
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Joy Fierro, Menasha
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Ronald Fissel, Menasha
George Franz, Neenah
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Armin Gerhardt, Appleton
Leroy Gerl, Oconto
Jack Giachino, Seymour
Rev. Gordon Gilsdorf, Sacred Heart, Oneida
Mike Gleffe, St. Matthews, DePere
Lillian Goddard, Coleman
Charles Gostas, Freedom
Karen Grunwald, St. James Luth., Shawano
Michael Haasch, Pulaski
Sr. Barbara Haase, St. Bernard, G.B.
Janelle Hagerty, Salvation Army, Green Bay
Robert Haen, Luxemburg-Casco
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Robert Haen, Luxemburg-Casco
Robert Haen, Luxemburg-Casco
Robert Haen, Luxemburg-Casco
Robert Haen, Luxemburg-Casco
Robert Haen, Luxemburg-Casco
This guide contains a series of episodes (mini-lesson plans), each containing a number of suggested in and out of class learning activities. The episodes are built around 12 major environmental concepts that form a framework for each grade or subject area, as well as for the entire K-12 environmental education series. This total K-12 environmental education series is the product of 235 classroom teachers from Northeastern Wisconsin. They created, used, revised and edited these guides over a period of four years. To this first step in the 1,000 mile journey of human survival, we invite you to take the second step--by using this guide and by adding your own inspirations along the way.

1. This I-C-E guide is supplementary in design--it is not a complete course of study, nor is its arrangement sequential. You can teach environmentally within the context of your course of study or units by integrating the many ideas and activities suggested. The suggested learning activities are departures from regular text or curriculum programs, while providing for skill development.

2. You decide when any concepts, objectives, activities and reference and resource materials can conveniently be included in your unit.

3. Any teaching situation, program or district seeking effective environmental education recommended for any school area emphasis, inter-grade coordination is highly recommended for any school. AVOID duplication and overlap where possible.

4. All episodes are built around 12 major environmental concepts that form a framework for each grade or subject area as well as for the entire K-12 subject area. Further, each episode offers disciplinary activities where applicable.

5. Subject-area integration, multiple subject area integration, economy of effort, and resource materials are useful to the teacher and students. Inter-grade coordination and articulation can be expanded thereby providing for skill development.

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1. The sun is the basic source of energy on earth. Transformation of sun energy to other energy forms (often begun by plant photosynthesis) provides food, fuel and power for life systems and machines.

2. All living organisms interact among themselves and their environment, forming an intricate unit called an ecosystem.

3. Environmental factors are limiting on the numbers of organisms living within their influence. Thus, each ecosystem has a carrying capacity.

4. An adequate supply of clean air is essential for life.

5. An adequate supply of clean water is essential to life.

6. The distribution of natural resources and the interaction between them determines man's values and priorities.

7. Cultural, economic, social, and political factors deter- mine man's values and priorities. Short-term economic gains may produce long-term environmental losses.

8. Environmental factors greatly affect the quality of life. Culture, education, technology, and environment are inter-related and must be considered in planning for the future.

9. Man has the ability to change his environment. Man must exercise this ability to meet current and future needs of society.

10. Short-term economic gains may produce long-term environmental losses.

11. Environmental factors such as facili-tating transportation, economic, social, and political factors deter- mine man's values and priorities. Short-term economic gains may produce long-term environmental losses.

12. Individual acts, duplicated or compounded, produce significant environmental alterations over time.

A Concept Rationale booklet and a slide/tape program "Man Needs His Environment" are available from the I-C-E RMC to further explain these concepts.
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**Table of Contents**
Environmental:

**CONCEPT NO.** 1 - Energy

**ORIENTATION** Energy

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<th>BEHAVIORAL OBJECTIVES</th>
<th>STUDENT-CENTERED LEARNING ACTIVITIES</th>
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<tr>
<td>Cognitive: Explain the importance of the food chain in the balance of nature.</td>
<td>In-Class:</td>
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<tr>
<td>Place himself as a link in the chain of life and place the sun as the main energy source, given an incomplete food chain.</td>
<td>A. Class</td>
</tr>
<tr>
<td>Affective: Support the &quot;sun's energy cycle&quot;, using basic research skills through the use of media.</td>
<td>1. Discuss the relationship of algae to the sun and its role in the food chain.</td>
</tr>
<tr>
<td>Argue that one must be careful not to destroy a link in the food chain when attempting to eliminate a specific animal or plant.</td>
<td>2. Construct a &quot;web of life&quot; with string which will show the interrelationships between plants, animals and man and their dependence on the sun.</td>
</tr>
<tr>
<td></td>
<td>1. Locate books on ecology showing food chains.</td>
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<tr>
<td></td>
<td>2. Find magazine articles dealing with the conversion of solar energy.</td>
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<td></td>
<td>B. Community</td>
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<tr>
<td></td>
<td>1. Field trips to discover food chains.</td>
</tr>
</tbody>
</table>

**Integrated with:**

**SUBJECT** Life Science

**TOPIC/UNIT** Research
SUGGESTED RESOURCES

CONTINUOUS OR ADDED LEARNING ACTIVITIES

Publications:

ICE field activity guide:
Tips for A Good Field Experience, ICE field activity guide, Cornell University.

Audio-Visual:
Filmstrips:

County Soil Conservation Office

School Librarian and Language Arts Teacher

Community:
County Soil Conservation Office
Environmental Concept No. Orientation

Energy Transfer

*Integrated with:*

**Life Science**

**Best Copy Available**

**BEHAVIORAL OBJECTIVES**

**Cognitive:**
- Construct a funnel-type respiration device using elodea subjecting it to various light conditions to show energy transfer of sunlight.
- Determine the relationship that exists between the amount of energy received from the sun and the respiration rate of plants and the cold.

**Affective:**
- Defend that there is a balance between the living organisms of nature and transfer of energy between living organisms.

**Skills Used:**
- Develop proficiency in performing experiments and investigations.
- Evaluate collected data.
- Write reports using graphs of data including an hypothesis drawn from observations.

**STUDENT-CENTERED LEARNING ACTIVITIES**

**In-Class:**

**Outside or Community:**

**Battery Jar**

**Funnel**

**Test Tube**

**Water**

**Elodea**

1. Place a sprig of elodea plant at the bottom of a battery jar 3/4 full of water and cover with a glass cover.
2. Place a strip of tape on the bottom of a funnel.
3. Place the funnel and plant over the open end of a water-filled test tube.


5. Grown collector.

6. Use of a funnel-type respiration device using elodea subjecting it to various light conditions to show energy transfer of sunlight.

7. Investigate the effect of the amount of energy received from the sun on respiration rate.

**CONTINUED:**

the water this
in the tube above. If any air remains of the funnel.
water-filled test
open end of a
tube. Place the stem of the elodea plant at

funnel.

water.

funnel.

jar.

test tube.

elodea.

water.

funnel.

jar.

test tube.

elodea.

water.

funnel.

jar.

test tube.

elodea.

water.

funnel.

jar.

test tube.

elodea.

water.

funnel.

jar.

test tube.

elodea.

water.

funnel.

jar.

test tube.

elodea.

water.
CONTINUOUS OR ADDED LEARNING ACTIVITIES

Audio-Visual:

SCIENTIFIC INQUIRY ANDproblem-solving

Level:

I. Three jars as described in #1 should be con-
2) Jar B should be placed in the light but not
1) Mark one jar A and place in direct sunlight.
2) Jar B should be placed in the light but not
3) Jar C should be placed in a darkened area.

In classroom:

d. Allow plans to remain in the funnel for at least
24 hours. Students will then, without removing
the test tubes, measure the amount of change in the
air space above the water.

e. Students should keep complete records of their
observations and data collected. A hypothesis
should be included to support their observations.

Note: The possibility of presence of oxygen can be
shown by removing the test tube and inserting
a glowing splinter of wood.

Publications:

SCIS Elementary Science Source book, Rand McNally and Co.,
Environmental Units, in cooperation with Minnesota Environmental
Sciences Foundation, National Wildlife Federation, "Plants in
the Classroom", ICE RMC, 120 NW.

Note:
The possibility of presence of oxygen can be shown by removing the test tube and inserting a glowing splinter of wood.
### Student-Centered Learning Activities

#### Life Science

<table>
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#### Environmental

<table>
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#### Behavioral Objectives

<table>
<thead>
<tr>
<th>Skill Used</th>
<th>Description</th>
</tr>
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<tr>
<td>1. Organizing materials for mobile construction</td>
<td>To determine the possible total effects of energy generation and desertification on the local community and food energy sources and food plans and sunlight.</td>
</tr>
<tr>
<td>2. Analyzing data</td>
<td>To analyze the total flow of food energy chain and the possible total effects of energy generation on the local community and food energy sources and food plans and sunlight.</td>
</tr>
<tr>
<td>3. Synthesizing resource material</td>
<td>To illustrate the total flow of food energy chain and the possible total effects of energy generation and desertification on the local community and food energy sources and food plans and sunlight.</td>
</tr>
<tr>
<td>4. Evaluating</td>
<td>To evaluate the specific purpose of the student's project as to completeness.</td>
</tr>
<tr>
<td>5. Basic language skills</td>
<td>To present a chart or other visual material and a resource material on energy sources and food chains.</td>
</tr>
<tr>
<td>6. Art skills</td>
<td>To develop a food energy chain and indicate its flow by art work in the form of a mobile.</td>
</tr>
</tbody>
</table>

#### In-Class

- **A.** The teacher will prepare a chart or other visual material and a resource material on energy sources and food chains. (Hangers, strings, paper etc. will be supplied.

#### Outside of Community

- **A.** The student will view the movie, Food Chains.
- **B.** Students may select any energy system in the local community and through art work, illustrate the total flow of food energy chain and the possible total effects of energy generation and desertification on the local community and food energy sources and food plans and sunlight.
- **C.** The student will develop a resource material on energy sources and food chains. (Hangers, strings, paper etc. will be supplied.
- **D.** The finished mobile will illustrate the concept of energy generation and desertification on the local community and food energy sources and food plans and sunlight.
- **E.** A movie entitled Green Plans and Sunlight will be shown with the specific purpose of the student evaluating his project as to completeness.

#### Community

- **A.** Students may select any energy system in the local community and through art work, illustrate the total flow of food energy chain and the possible total effects of energy generation and desertification on the local community and food energy sources and food plans and sunlight.
- **B.** Students will select insecticide and describe the possible total effects on their energy system. (Resource material on energy sources and food chains. (Hangers, strings, paper etc. will be supplied.
- **C.** The student will develop a food energy chain and indicate its flow by art work in the form of a mobile.
- **D.** The finished mobile will be displayed and the student will explain his project.
- **E.** A movie entitled Green Plants and Sunlight will be shown with the specific purpose of the student evaluating his project as to completeness.

#### Affective

- **A.** Offer suggestions concerning solutions to food chain crises when presented with such situations.

#### Skills Used

1. Organizing materials.
2. Analyzing data.
3. Synthesizing resource material for mobile construction.
4. Evaluating.
5. Basic language skills in presentation to class.
6. Art skills.
Publications:
- Foundations of Life Science, Trump, Volker, Holt, 1971
- Investigations into Ecology, ICE RMC, 110 Ec Communities -- Science Curriculum Improvement Study, 1969, ICE RMC, 110 Kn

Audio Visual:
- Posters of food chains on bulletin board
- Films:
  - Food Cycle and Food Chains, BAVI
  - Green Plants and Sunlight, BAVI

Community:
- Field trip to local wooded area
- Vacant lot or cemetery
- Field trip to local wooded area

continued or added learning activities
BEHAVIORAL OBJECTIVES

Cognitive:

1. Explain the reason for natural succession in an ecosystem.
2. Analyze a change in an ecosystem to determine whether it is natural succession or an interruption of succession.
3. Attempt to identify characteristics of changes in an ecosystem that are the result of natural succession.

Skills Used:

1. Finding comparative data.
2. Discussion of succession & its changes on a community.

Outside of Community:

A. The students in small groups should be supplied with three one-gallon jars per group.
B. 1. First jar--1 gallon water, 1/2 gallon pond water, 1/2 gallon sterilized pond water, assortment of algae, dead leaves and pond leaves, and pond algae. Place an assortment of algae and leaves in a jar.
2. Second jar--1" fine gravel, 1/2 gallon pond water, sterilized pond water, several organisms from pond, cover jars with cellophane, and place in indirect sunlight or under lamp. Cover jars and place in indirect sunlight.
3. Third jar--2/3 gallon pond, river or lake, sterilized pond water, 2/3 gallon pond, river or lake water, unsterilized pond, unsterilized lake water, several organisms from pond, cover jars with cellophane, and place in indirect sunlight or under lamp. Cover jars and place in indirect sunlight.

Affective:

1. Investigate the process of succession which is affected by man's uncontrolled technology.
2. Attempt to identify characteristics of changes in an ecosystem that are the result of natural succession.

Project III - PROJECT I-C-E 59-70-015-4
Community: Life in a Pond, BAVI

Note: The 8-day growth period should allow enough time for good growth and development of organisms within the aquatic environments.

The student's report will be based on observation of accumulated data from the creation of a biological community illustrating the interaction of living things. Acceptable performance will include a controlled experiment with sterilized and unsterilized pond water, classifying by common names organisms which appear after an 8-day growth period and observing growth changes in each of the three jars. These changes will be presented in a short paragraph form, results of which will be based on observation of changes obtained from the aquatic environments.

Note: The 8-day growth period should allow enough time for good growth and development of organisms within the aquatic environments.

Audio-Visual:

Films:
- Life in a Drop of Water, BAVI
- Life in a Pond, BAVI

Publications:
- Modern Life Science
- Interactions of Man and the Biosphere, Rand McNally
- Algae in Water Supplies, U.S. Dept. of Agriculture

Classroom (Continued)
### Behavioral Objectives

#### Cognitive:
- Determine the population of small plants in a given area using the sampling technique.
- Propose several ways in which the carrying capacity of a given area might be increased.

#### Affective:
- Support the statement that environmental resources determine the carrying capacity of an area.
- Demonstrate the relationship between the number and kinds of plants present in the area and plant populations.

### Skills Used:
- 1. Observing.
- 2. Comparing.
- 3. Recording and interpreting data.

### Student-Centered Learning Activities

#### In-Class:
- Students, working in small groups, should construct a sampling device to be used to randomly sample and survey an area for plant populations.
  - **A. Fish trap for sampling.**
  - **B. Demonstrate how to throw the fish trap.**
  - **C. Examining and counting species.**
  - **D. Comparing fish populations.**
  - **E. Record data.**

#### Outside or Community:
- A. Field trip for sampling plant populations.
  - **A. Test sites.**
  - **1. Land around the school.**
  - **2. Vacant lots.**
  - **3. Roadside.**
  - **4. Cemetery.**

### Environment:
- Best Copy Available

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**Topic/Unit:** Plant Communities

---

**Subject:** Life Science

---

**Integrated with:**

---

**Orientation:**
- Concept No. 3 - Carrying Capacity
- Environmental Science

---

**Behavioral Objectives:**
- 1. Recording and interpreting data.
- 2. Comparing.
- 3. Observe.
SUGGESTED RESOURCES

CONTINUED OR ADDED LEARNING ACTIVITIES

Publications:
- Interaction of Man and The Biosphere, Rand-McNally
- BSCS: Green Version, Rand-McNally

AudioVisual:
- Films:
  - Distribution of Plants and Animals, BAVI
  - Desert, BAVI
  - High Arctic Biome, BAVI

Audio-Visual:
- BSCS: Green Version, Rand-McNally

Publication:
- Interaction of Man and The Biosphere, Rand-McNally

Community:

COGNITIVE (Continued)

why the population existed there in such types and numbers.
Environmental: Concept No. 4 - Water Orientation

Water Analysis Integrated with: Life Science

Behavioral Objectives

Cognitive:
1. Determine the quality of water in a given body of water (stream, lake, etc.) by properly sampling and analyzing the samples.
2. Evaluate data obtained from water sampling investigations in his area to determine if it was properly obtained and is representative of the area being studied.

Affective:
1. Investigate the quality of the water resource in his area.
2. Suggest ways his water quality can be preserved or maintained.

Skills Used:
1. Water sampling techniques.
2. Interpreting experimental data.
3. Acquiring new values pertaining to dangers of water pollution.

In-Class:
A. Analyzing samples.
1. Students should prepare microscope slides or observe water samples under a binocular microscope or hand lens.
2. Tests which were started in the field should be completed in the classroom.

B. Report of findings.
1. Students should prepare a written report which will include all data collected and an evaluation made of their findings. Their evaluation should be based on deviations from accepted norms for the particular water source under study.
2. Reports should be presented to the class followed by a discussion of local water problems and pollution to dangers of water pollution.

Outside or Community:
A. Water sampling.
1. Students in small groups will collect two water samples in clean, sterilized bottles.
   a. One sample should be collected in a dissolved oxygen collection bottle.
   b. The other sample collection bottle.
2. Tests which were started in the field should be completed.
3. Water samples should be kept in a cool place for not more than 2 days.
4. Water samples should be delivered to the D.O. bottle through a siphon tube with a minimum of agitation.
5. Bottles should be labeled with the following:

<table>
<thead>
<tr>
<th>WATER QUALITY</th>
<th>Water Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Science</td>
<td>Water</td>
</tr>
<tr>
<td>Concept No. 4</td>
<td></td>
</tr>
</tbody>
</table>

Student-Centered Learning Activities

Table:

<table>
<thead>
<tr>
<th>BEHAVIORAL OBJECTIVES</th>
<th>In-Class</th>
<th>Outside or Community</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Analyzing samples</td>
<td></td>
<td></td>
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<tr>
<td>B. Report of findings</td>
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<tr>
<td>A. Water sampling</td>
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<tr>
<td>A. Clean, sterilized</td>
<td></td>
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<tr>
<td>B. Tests in the field</td>
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<tr>
<td>B. Tests in the field</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Subject: Life Science

Topic/Unit: Water Quality

Orientation: Water Analysis

Concept No.: 4 - Water Environmental:
SUGGESTED RESOURCES

CONTINUOUS OR ADDED LEARNING ACTIVITIES

Publications:
1. The Clean Brook, Margaret Bartlett
2. Water: Riches or Ruin, Helen Bauer
3. Busy Water, Alaska's Stream Booklet
4. The Quests, ICE RMC, Film #280
5. The Gifts, ICE RMC, Film #320

Audio-Visual:
1. Public Health Association Public Use Laws of Water in Wisconsin, 10 x 6" plastic
2. Booklet: Public Use Laws of Water in Wisconsin
3. Booklet: Public Use Laws of Water in Wisconsin

Standard Methods for Examination of Water and Wastewater, 2nd Ed., Ed. A.O. References

Standard Methods for Examination of Water and Wastewater, Am. Pub. Health Association

Audio-Visual:
1. Film #280: The Gifts, ICE RMC
2. Film #320: The Quests, ICE RMC
3. Film #320: The Gifts, ICE RMC

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Cognitive:
Describe the relationship that exists between the type and degree of pollution of water and the effect on *Spirogyra*.

Compare the effect of pollution on *Spirogyra* and the effect on higher animals.

Environmental:

<table>
<thead>
<tr>
<th>CONCEPT NO.</th>
<th>CONCEPT</th>
<th>Orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>4</td>
<td>Water</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>Integrated with:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Science</td>
<td>Water Quality</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BEHAVIORAL OBJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Prepare microscope slides.</td>
</tr>
<tr>
<td>2. Use microscope.</td>
</tr>
<tr>
<td>3. Practice in preparing microscope slides.</td>
</tr>
<tr>
<td>4. Synthesize results.</td>
</tr>
</tbody>
</table>

Materials:
- 4 sets of slides, each with a drop of water.
- 4 sets of slides, each with a drop of different salt solutions.
- Forceps, microscope slides, medicine dropper, fresh water.

Skills Used:
- Practice in preparing slides.
- Using microscope.
- Analyze experimental data.
- Synthesize results.

In-Class:
1. **A.** Marine communities.
   - Four 1-pint bottles of different salt solutions.
     - 1 tsp. in 1st pint.
     - 4 tsp. in 2nd pint.
     - 8 tsp. in 3rd pint.
     - 16 tsp. in 4th pint.
   - 1 bottle of fresh water.

2. **B.** With forceps, place a strand of *Spirogyra* in the water on the slide. Place a cover slip over the drop and study under the microscope.
3. **C.** With forceps, place a drop of fresh water on the microscope slide. Place a cover slip over the drop.
4. **D.** Place a drop of the weakest salt solution on another slide. Place a cover slip over the drop and study under the microscope.

(Continued)

A. **Outside activities.**
1. **A.** Students will sample fresh water from several locations in the community or adjacent waters, and test for different types of pollution.
2. **B.** The students will measure the effect on higher animals and describe the relationship between type and degree of pollution of water and the effect on higher animals.

Volunteer comments on ways water resources should be handled and proposals made for such resource management.

Affective:
- Volunteering on a regular basis.
- Discussion on pollution and the effect on higher animals.
- Discussion on pollution and the effect on *Spirogyra*.

Skills used:
- 1. Practice in preparing slides.
- 3. Practice in preparing microscope slides.
- 4. Synthesize results.
Continued or Added Learning Activities

Publications:
- Environments, teacher's guide, SCIS, Rand McNally, ICE RMC

Audio/Visual:
- Film: Life in a Drop of Water, BAVI
- Equipment:
  - Microscope slide
  - Spirogyra
  - Salt
  - Forceps
  - Eyedropper
  - 4 pint jars
  - Microscope
  - Micro-slide
  - Cover slips
  - Teaspoon
  - Eye dropper
  - Scalpel
  - Forceps

Community:
- Classroom (Continued)
  - Microscope slide, add Spirogyra and cover slip.
  - Make a drawing with a written description of each of the solutions.
  - Repeat procedure with other salt solutions.
  - Observe changes in cell content and appearance.
  - Make a note of the time it takes before you see any changes in the appearance of Spirogyra for each solution.
  - Make a note of the time it takes before you see any changes in the appearance of Spirogyra for each solution.
  - Repeat procedure with other salt solutions.

Suggested Resources
- 120 KA
### Subject: Life Science

#### Topic/Unit: Water Quality

#### Concept No.: 4 - Water

#### Orientation: Habitat Determination

<table>
<thead>
<tr>
<th>Behavioral Objectives</th>
<th>Student-Centered Learning Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cognitive:</strong></td>
<td></td>
</tr>
<tr>
<td>Determine how indicator organisms that live in fresh water can show importance of clean water to maintain the balanced water community.</td>
<td></td>
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<tr>
<td>A. Class Discussion.</td>
<td></td>
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<tr>
<td>B. Procedure.</td>
<td></td>
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<tr>
<td>C. Rod organisms in Q. Purity Levels.</td>
<td></td>
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<tr>
<td>D. Temperature.</td>
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<tr>
<td>E. Class Discussion.</td>
<td></td>
</tr>
<tr>
<td>F. Knowledge of relationships between organisms.</td>
<td></td>
</tr>
<tr>
<td>G. Understanding how or why all living things are dependent on unpolluted water.</td>
<td></td>
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<tr>
<td>H. Upper watershed needs.</td>
<td></td>
</tr>
<tr>
<td>I. Oxygen levels.</td>
<td></td>
</tr>
<tr>
<td>J. Trout need.</td>
<td></td>
</tr>
<tr>
<td>K. Streams which trout swim in.</td>
<td></td>
</tr>
<tr>
<td>L. Rod organisms in area. For. Treat.</td>
<td></td>
</tr>
<tr>
<td>M. Trout quality of H2O.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Affective:</strong></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Propose that future generations will take care of our water resources with more concern than present and past generations.</td>
<td></td>
</tr>
<tr>
<td>A. Class Activity.</td>
<td></td>
</tr>
<tr>
<td>B. Note. Outside resource and community activities.</td>
<td></td>
</tr>
<tr>
<td>C. Class Discussion.</td>
<td></td>
</tr>
<tr>
<td>D. Compare indicator organisms.</td>
<td></td>
</tr>
<tr>
<td>E. Present condition of water must remain clean to maintain the balanced water community.</td>
<td></td>
</tr>
</tbody>
</table>

#### Skills Used:
- 1. Accumulating scientific data.
- 2. Knowledge of relationships between organisms.
- 3. Understanding how or why all living things are dependent on unpolluted water.

#### In-Class:
- Class Discussion.
- Procedure.

#### Outside or Community:
- Class Discussion.
- Compare indicator organisms and their problems to show effects of water pollution on living creatures.
- Divide class into groups, assign each group a fresh water indicator organism to study that is or was native to the area. Ex. trout.
  - a. Temperature.
  - b. Purity levels.
  - c. Food organisms in streams which trout swim in.
  - d. Oxygen levels.
  - e. Upper watershed needs.
  - f. Protective cover.
  - g. Erosional rates.
  - h. Protective cover.
  - i. Tract quantity of H2O.
  - j. Trout quality of H2O.

#### Note:
Outside resource and community activities should proceed in class discussion.

---

**E.S.E.A. Title III - PROJECT I.C.E. 59-70-0135-A**
Continued or Added Learning Activities

Skills (Continued)

4. Understanding of the DNR and its role in protecting our non-renewable resources.

Outside Activities (Continued)

6. List possible courses which might be undertaken to improve deteriorating conditions.

7. Show the relationship between all life in the streams and water quality.

Audio-Visual:

Community:

Tips for a Good Field Experience.

Publications:

Official Local DNR fish management Wisconsin Conservation Bulletins DNR

The Clean Brook, Margaret Bartlett

Water, Our Most Valuable Natural Resource, Ivan Green

DNR Wisconsin Conservation Bulletins Local DNR fish management

Community:
Environmental

Integrated with:

CONCEPT Na

SUBJECT Life Science

BEST COPY AVAILABLE

ORIENTATION

Effects of Selected Pollutants

TOPIC /UNIT Water Quality

BEHAVIORAL OBJECTIVES

Cognitive:

1. Demonstrate, using a microscope, that unpolluted water is essential for sustaining life.
2. Describe the effects of foreign materials on an unbalanced environment.

Affective:

3. Demonstrate a change in attitude toward water quality by making a list of materials, which should not be used or put into water supplies.
4. Propose that such contamination must cease and that programs to end such pollution should be developed to prevent water pollution.

Skills Used:

1. Planning a pond.
2. Accumulating appropriate pond organisms.
3. Analyzing and synthesizing data.
4. Organizing materials and scheme to test organisms and pollutants.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

1. Organize materials and scheme to test organisms and pollutants.
2. Analyzing and synthesizing data.
3. Acculturating appropriate pond organisms.
4. Planning a pond.

Outside or Community:

A. Fresh water communities.
   1. Set up two aquariums containing several kinds of water plants, fish and snails.
   2. Students develop hypotheses on the nature of the rise and fall of the population of the micropond.
   3. Students will make a useful study of the micropond communities using the following guide:
      a. Type of algae found,
      b. Increase or decrease in population.

(Continued)
B. Select a commonly used product which is flushed down home drains. An example would be:

- Detergent
- Auto polish
- Soap
- Water soluble paint
- Fertilizer
- Insecticide
- Poison
- Disinfectant
- Toothpaste
- Hair spray

C. Introduce the selected substance into one of the micro-ponds. Make observations on both communities and record observations, distinctions, concentrations, and notes. An example would be:

- Detergent
- Soap
- Water soluble paint
- Fertilizer
- Insecticide
- Poison
- Disinfectant
- Toothpaste
- Hair spray

Note to Teacher: Students should write a brief outline of their experiment before performing it. Be fully controlled to be a meaningful investigation. I. The amount of substance introduced should be carefully controlled to be a meaningful investigation. Any changes noted following the format of "3" above must be carefully noted. Make observations on both communities and record observations, distinctions, concentrations, and notes. An example would be:

- Detergent
- Soap
- Water soluble paint
- Fertilizer
- Insecticide
- Poison
- Disinfectant
- Toothpaste
- Hair spray
### Environmental Concept No. 5

**Respiration in Plants**

**Integrated with:**
- Life Science
- Air Pollution

### Behavioral Objectives

**Cognitive:**
- Describe respiration including the roles of CO₂ and O₂.
- Analyze the statement, "While polluted air may make it difficult for animals to have respiration, it has no effect on plants."

**Affective:**
- Suggest that living organisms need air to survive and assist in energy release within the organism itself.
- Attempt to observe the use of oxygen by the plant.

### Skills Used:
- 1. Comparing and recording
- 2. Discussion of mental effects of air pollution

### In-Class

1. The use of CO₂ and O₂ in plants.

### Outside or Community

2. Discussion of environment and respiration

<table>
<thead>
<tr>
<th>STUDENT-CENTERED LEARNING ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Behavioral Objectives</strong></td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
</tr>
<tr>
<td><strong>Respiration in Plants</strong></td>
</tr>
<tr>
<td><strong>Air Pollution</strong></td>
</tr>
<tr>
<td><strong>Life Science</strong></td>
</tr>
<tr>
<td>Integrated with:</td>
</tr>
</tbody>
</table>

#### In-Class:

1. The use of CO₂ and O₂ in plants.

| 1. Pour bromthymol blue solution into a beaker.
| 2. With a straw, blow your breath into the solution.
| 3. Place a sprig of elodea into the bromthymol blue solution in the beaker.
| 4. Yellow upon introduction of CO₂.
| 5. Fill the six test tubes with yellow converted bromthymol solution and stopper.
| 6. All test tubes should be placed in medium sunlight.

#### Outside or Community:

1. The use of CO₂ and O₂ in plants.

#### Affective:

- Suggest that living organisms need air to survive and assist in energy release within the organism itself.

#### Cognitive:

- Discuss the respiration in plants.
Publications:

AudioVisual:

Films:

Photos, 3AVI

Cf-66iinariEland Sunlight, BAVI

Equipment:

6 test tubes and stoppers

BAVI

Green Plants and Sunlight, BAVI

Photoynthesis, BAVI

Audio-Visual:

Classroom (Continued)

2. Determination of optimum light color for photosynthesis:
   - Color of yellow bromthymol blue.

3. The student will then discuss where the oxygen goes which is produced by the plant as the CO₂ is used up.
   - Color of yellow bromthymol blue.
   - Student investigation of CO₂ use by plants should be continued.
<table>
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<tr>
<td><strong>Cognitive:</strong></td>
<td><strong>Outside or Community:</strong></td>
</tr>
<tr>
<td>Explain effects of air pollution on various diseases by collecting data, articles, statistics and writing to states and cities to find any facts that pertain to air pollution and its effect as a disease-causing agent.</td>
<td>Group research paper.</td>
</tr>
<tr>
<td>Carry on a detailed research study of pollution and how it affects the nation's health. Volunteer ideas indicating that polluted air is a hazard to all living things and to all future generations.</td>
<td>Class will be divided into 4-5 groups with a group leader or chairman. Each group will conduct a survey on the effects of air pollution and the contraction rate of a particular disease. Possible study areas: a. Lung cancer. b. Heart disease. c. Emphysema. d. Tuberculosis. e. Pneumonia.</td>
</tr>
<tr>
<td><strong>Affective:</strong></td>
<td><strong>In-Class:</strong></td>
</tr>
<tr>
<td>Carry on a detailed research study of pollution and how it affects the nation's health. Volunteer ideas indicating that polluted air is a hazard to all living things and to all future generations.</td>
<td>Group leaders will assign study areas: a. Regional areas (state health departments). b. Large cities (health departments). c. Library research. d. Magazine and newspaper articles.</td>
</tr>
</tbody>
</table>

**Skills Used:**
- Journalism skills.
- Data collecting.
- Understanding of the real danger of air pollution.
- Understanding the principle of diffusion.
e. Summary and conclusions (values—before and now).

5. Ability to evaluate and draw conclusions.

CLASSROOM (continued)

5. Report for class presentation.
6. Wilderness area or states.
7. Health bulletins and manuals.
8. Interviews with experts.

E. Local health officials.
D. Physicians, etc.
C. Affected citizens.
B. Present day pollution problems.
A. Affected areas.

5. Each group will accumulate material and prepare a report on pollution problems.

e. Interview:

1) Local health officers.
2) Physicians, etc.
3) Community leaders.
4) Affected citizens.
5) Affected areas.

d. Future of pollution problems.

4. Question and answer period.

3. Present day pollution problems.

2. Industrial, etc.

1. Transportation, etc.

D. Audio-Visual

Clark Publishing Company

20 Beach Street

Navesink, NJ

Lucy Kavaler

Dee Kester

J. Of Pollution: How To Stop Air Pollution.

The World You Inherit: A Story

This Vital Air: Thomas Aylesworth

McGraw-Hill, Inc.

Teaching Basic Speech Experiences.

Do you think air pollution is everywhere?

Do you think air pollution reaches a degree (to a degree)?
Environmental

CONCEPT NO. 6 - Resources

ORIENTATION Populations

Integrated with:

SUBJECT Life Science

TOPIC/UNIT Ecosystems

BEHAVIORAL OBJECTIVES

Cognitive:

List, in written form, the geographic conditions responsible for larger populations of these species through observation of ant hill populations and guppy populations.

Analyze those conditions responsible for smaller populations for comparison of the two lists of geographic conditions.

Affective:

Support the proposal that natural resources are not distributed equally and thus affect the quality of life in any given area.

Skills Used:

1. Observation.
2. Systematic counting.
3. Comparing data.
4. Writing a scientific report.
5. Analyzing data.

In-Class:

A. Observe a guppy population.

1. Determine size of population by counting organisms.
2. Determine density of population by computing number of organisms per unit area.
3. Describe physical environment of organism noting size, soil type and amount, amount of water, number of plants and large rocks, amount of sunlight, type and amount of additional organisms. Try to estimate the number of organisms. Try to determine which organisms are present.
4. Continue observation over two week period making daily records.

Outside or Community:

A. Find an ant hill or nest of carpenter ants. Try to estimate the number of organisms. Determine the population density. (Use ants per hill or nest) Determine the expected fluctuations in the ant population. Describe the physical area the ants live in, the physical characteristics of the hill or nest, and the size of the nest. Determine the expected fluctuations in the ant population.

In any given area, affect the quality of life.

Support the proposal that natural resources are not distributed equally and thus affect the quality of life in any given area.

Skills Used:

1. Observation.
2. Systematic counting.
3. Comparing data.
4. Writing a scientific report.
5. Analyzing data.
<table>
<thead>
<tr>
<th>Community:</th>
<th>University ecologist, Agricultrist, Forest ranger, Forest manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio-Visual:</td>
<td>Film: Distribution of Plants and Animals, BAVI, Forest manager, BAVI, Modern Life Science, Fitzpatrick, BAVI</td>
</tr>
</tbody>
</table>

**Continued or Added Learning Activities**
Environmental Concept No. ORIENTATION

Impacts of Environmental Change

TOPIC / UNIT: Land Use

Integrated with:

SUBJECT: Life Science

BEHAVIORAL OBJECTIVES

STUDENT-CENTERED LEARNING ACTIVITIES

Cognitive:

List changes in land use for human considerations rather than for the balance of the environment.

Report on one case from the student's list that has a definite impact on local area.

Affective:

Advocate or reject the way man has viewed the overall environment as compared to the importance of man's immediate and material gains.

Skills Used:

1. Scientific technique.
2. Problem solving.
3. Decision making.
4. Personal values.

In-Class:

Outside or Community:

A. Research project.
   1. Part one.
      a. Complete an extensive list of changes in land use which have resulted from factors other than preservation of the environment.
   2. Part two.
      a. Extensive research report on one land use change on your list.
      b. Encourage:
         1) Objectivity.
         2) Opinions of local people.
         3) Overall impact of change.
         4) Conclusions.
   3. Part three.
      a. All students should present their research reports to the class for overall discussion and  

A valuable field experience can be gained from the use of "A Land Ethic," an ICE field activity guide. Available from the ICE RMC.
SUGGESTED RESOURCES

CONTINUED OR ADDED LEARNING ACTIVITIES

Publications:
- Tips for a Good Field Experience, ICE field activity guide.
- A Land Ethic, ICE field activity guide.

AudioVisual:
- Films:
  - Population Problem, U.S.A
  - Seeds of Change, BAVI
  - Standing Room Only, BAVI

Community:
- Local papers
- Library
- Government officials
- County courthouse
- Local agriculture agent
- Corporation environmental control agent
- University biologists or guest lecturers

CLASSROOM (Continued)

Location and date of change.

Evaluations. Each environmental change should be examined as to reason and/or capital gain. Values that will classify as group or individual evaluation. This will present the class with

Standing Room Only, BAVI
Seeds of Change, BAVI
Population Problem, U.S.A

Audio-Visual:

Tips for a Good Field Experience,
ICE Field Activity Guide.

Guides:

A Land Ethic, ICE Field Activity Guide.
### Cognitive

**Activity #1**

- Utilizing water-use figures, students graph consumption rates for their local community. Factors that contribute to increased water consumption can be developed by class.

**Activity #2**

- Students can attempt to project the effect on the world's supply of natural resources if an underdeveloped country were to become highly westernized. For example, if China were to have the same number of automobiles per capita as the U.S., certain changes in men's values toward utilization water-use would occur.

### Affective

Defend the fact that the status of man's values toward his environment must be re-evaluated and emphasis placed on mutual harmony with nature. Acceptable performance will include the presentation of an activity designed to show how man's values and attitudes have been shaped by factors other than the preservation of the natural environment. It will also be acceptable if the class chooses to discuss the above concept through the following activities:

1. Activity #1
   - Follow above activities
2. Activity #2
   - Students will be divided into four groups to discuss above concept.
SUGGESTED RESOURCES

CONTINUED OR ADDED LEARNING ACTIVITIES

Publications:
The Effects of Overpopulation, Richard Kimball, ICE RMC, 190 Ki
Population Bomb, Paul Ehrlich, New York, Ballantine Books
World Almanac

Audio-Visual:
Films:
Bulldozed America, BAVI
Man's Impact on His Environment, BAVI
Cry of the Marsh, ICE RMC, Film #390
The Tree House, Holt, Rinehart

Community:
City water department
Local city officials
Ford Motors, Detroit, MI

Cognitive (Continued)
fluenced by the negative use of our natural environment.

Classroom (Continued)

Activity #3 - Assume that a small community were influential by the negative use of our natural environment.

Activity #4 - A class or group with the least number of natural resources that are used in the manufacture of an automobile. A similar list of natural resources that were used in the manufacture of a 1930 auto could be developed and a comparison made. Each group will also list problems of their study area and what possible solutions may avert these problems in the future. Groups will present their study area to the class for discussion and possible values involved.

B. In the Future

C. Each group will also list the problems of their study area.

3. Activity #3 - Assume that a small community were influential by the negative use of our natural environment.

4. Activity #4 - A class or group with the least number of natural resources that are used in the manufacture of an automobile. A similar list of natural resources that were used in the manufacture of a 1930 auto could be developed and a comparison made. Each group will also list problems of their study area and what possible solutions may avert these problems in the future. Groups will present their study area to the class for discussion and possible values involved.
### Behavioral Objectives

**Cognitive:**
- Research and orally report on four historic blunders of man which have backfired on him in his efforts to achieve short-term economic gains.
- Evaluate a change in the ecosystem to determine if the change is positive or negative in regard to the habitat.

**Affective:**
- Support that man has hastened the destruction of his environment with his shortsightedness and greed.
- Advocate values which will prevent this from happening in the future.

**Skills Used:**
2. Development of environmental values.
3. Need for better planning & experimentation before implementation.
4. Integrated with:
   - Need for better planning & experimentation before implementation.
   - Development of environmental values.
   - Knowledge of statistics.

### Student-Centered Learning Activities

#### In-Class:
- **Class Project**
  1. Divide class into small groups.
  2. Each group conducts a survey and prepares an oral report on local or national instances which will attempt to prove Concept #10.

  **Possible Examples:**
  - Introduction of carp from Europe.
  - Introduction of Dutch elm disease.
  - Introduction of citrus fruit trees.
  - Introduction of Japanese beetle.
  - Introduction of potato blight.
  - Introduction of Japanese beetle.
  - Introduction of hoof and mouth disease.

#### Outside or Community:
- **Guest Speaker**
  1. DNR representative to speak on introduction and effects of foreign species to the ecosystem and laws which are designed to prevent such introductions.
  2. Small groups conduct a survey and prepare an oral report on an instance which will prove that man has hastened the destruction of his environment with his shortsightedness and greed.

#### Constraints:
- Achieve short-term economic gains.
- Achieve long-term economic gains.
- Economic Planning.
- Life Science.
- Ecosystems.
- Subject: Life Science.
- Concept No: 10 - Economic Planning.
### Environmental Quality

**Behavioral Objectives: Environmental Quality**

- **Cognitive:**
  - Construct a slide, movie, or photograph sequence showing individual acts which have resulted or could result in a degraded environment. The student will present his slides to the class along with an oral report of his findings.
  - Propose how these individual acts should be controlled to save the environment.

- **Affective:**
  - Seek out what he considers to be an individual act resulting in environmental alteration.
  - Propose how these individual acts should be controlled to save the environment.

**Skills Used:**

1. Photography.
2. Organization of a slide, movie, or photograph sequence.
3. Observing.
4. Speaking skills.
5. Creativity in photography presentation.

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### In-Class

- Select groups for making a photographic sequence showing environmental problems leading to its degradation.
- The students will construct a community survey asking questions concerning actions which have taken place in the community and local degradation of the environment which have resulted in environmental alteration.

<table>
<thead>
<tr>
<th>Concept No.</th>
<th>Individual Acts Which Affect Environmental Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Science</td>
<td>Environmental Quality</td>
</tr>
</tbody>
</table>

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### Outside or Community

- The students will go into the community and photograph acts which lead to the degradation of the environment and construct a photographic presentation showing man destroying his environment both short and long term.
- Students can construct a community survey asking questions concerning actions which have resulted in environmental alteration.

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### Student-Centered Learning Activities

- The students will select groups for making a photographic sequence showing environmental problems leading to its degradation.
- The students will construct a community survey asking questions concerning actions which have resulted in environmental alteration.

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### Orientation

- **Concept No.:** II - Individual Acts Which Affect Environmental Quality
SUGGESTED RESOURCES

Publications:
- Photography magazine in library

Audio-Visual:
- Film: The Gifts, ICE MC, Film #280
- Filmstrips on ecology and environment available in most schools
- George Howlett, Project ICE, illustrates how a photography series is constructed

Community:
- School AV man can come in and illustrate how a photography series is constructed
- George Howlett, Project ICE, on environmental photography

Photography magazine in library

CONTINUED OR ADDED LEARNING ACTIVITIES

SUGGESTED RESOURCES