
Sustainability Unit Example: K-5 Science Integration

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How do curriculum and instruction change when sustainability becomes the guiding approach? How does the content become richer? How does the level of inquiry deepen? This document provides an example of a teacher-created unit that is grounded in the content and pedagogy of sustainability education.

Background

The unit described was an outcome of the 2007 Summer Sustainability Institute sponsored by the Children’s Environmental Literacy Foundation (CELf: <http://www.celfoundation.org>), with facilitation provided by Creative Change Educational Solutions(<http://www.creativechange.net>), and Scott Beall consulting. During the intensive week-long institute, teachers gained content knowledge, resources and strategies to redesign their approach to curriculum and instruction using the lens of sustainability. Guided planning time and one-on-one mentoring at the institute enabled teachers to walk away with a draft unit plan to implement during the school year.

After the week-long institute, the teachers were provided on-going support and communication. Teachers sent their in-progress lesson plans to Creative Change and CELf, and received feedback and mentoring via phone and e-mail. This document is an outcome of this process.

Sustainability Education Project
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Introduction by teacher:

My primary work as teacher is to support K-5 teachers in science. Throughout the week-long institute, I tried to think of ways that sustainability concepts could be integrated into an already crowded curriculum. The following chart shows suggestions for changing existing units to emphasize sustainability. I have chosen one to explore: writing parallel lessons to the third grade Wisconsin Fast Plants study.

Overall objectives:

- To make teachers and their students aware of human interdependence with the living and nonliving elements of earth, and of the actions that can deplete those resources.
 - To illustrate what can be done to reverse negative trend.
- To motivate teachers and students to adopt sustainable practices, possibly through a Superintendent's Conference Day program.

Suggestions for Integrating Sustainability Concepts into K-5 Science

Grade	Unit	Sustainability Objectives	Sustainability activities
2	Recycling (Social Studies unit)	Students will be motivated to recycle by learning about the materials of which disposables are made, and the ways they are recycled.	Field trip to recycling center. Examine recyclables and their numbers, and sort accordingly.
3	Plant Life Cycles (Wisconsin Fast Plants)	Students will ask and answer questions relating to the effect of pollutants on plant growth and begin to understand the concept of a "fair test." Students will understand that organisms have basic needs.	Design an experiment to compare the health and growth of plants watered with pollutants with those watered with pure water. (Details below)
3	Energy Unit	Students will understand that: The electrical energy we use is usually generated by water or steam power. Heat used to generate steam usually comes from burning coal, or from nuclear energy. Coal and nuclear power plants are sources of pollution.	Students will use a hand-operated generator to illustrate transformation of mechanical energy to electrical energy, and investigate the sources of mechanical energy that generate the electricity we use. (See connection to Water unit, below.)

Grade	Unit	Sustainability Objectives	Sustainability activities
3	FOSS Water unit	<p>Students will begin to understand the importance of water conservation.</p> <p>Students will understand how the energy of moving water can be used to When students design the working water wheel to lift a weight, introduce the idea that water power is sometimes used to generate electrical energy.</p>	<p>Music teachers could use songs such as “Someone’s Gonna Use It After You.”</p> <p>Use the Genecon to demonstrate how mechanical energy is converted to electricity, and ask how water power could supply the motion.</p>
4	Pond Life Zoo trips relating to habitats and endangered species	Unit objectives already include concepts of interrelationships within an ecosystem, and the effect of human activity on the survival of some species.	Draw parallels among pond community and earth habitats, including our own. Who are the producers, consumers, scavengers, etc?
4	Rocks and Minerals	<p>Add Big Ideas relating to coal and oil:</p> <p>They are important as sources of energy and materials for plastics, medicine, fabrics, etc.</p> <p>They were formed millions of years ago.</p> <p>They are in danger of being depleted within a short time.</p> <p>We are using them up at a rapid rate.</p> <p>They are not renewable.</p> <p>Other objectives relate to conservation of other materials obtained from the earth, such as aluminum.</p>	<p>Resources available through the Mineral Information Institute www.mii.org</p> <p>and on the Energy Kid’s Page at www.eia.doe.gov/kids/</p>
5	Electricity/Magnetism	<p>Students will understand that:</p> <p>Power plants that rely on coal or nuclear power may pose a danger to the environment.</p> <p>Alternate energy sources are being explored.</p>	<p>Review sources of pollution connected to electricity generation, and research alternate energy sources: solar, wind, geothermal, etc.</p> <p>Energy Kid’s Page at www.eia.doe.gov/kids/</p>
5	Models and Designs	Use properties of materials to design a machine.	Design a machine that will use alternate energy or save on energy used.

Example of a Third Grade Unit

Unit Title: Investigating the Effects of Pollutants on Plant Growth

(to be done in third grade while investigating the plant life cycle with Wisconsin Fast Plants)

Current objectives – students will:

- ask and answer questions relating to plant growth.
- employ simple measurement tools to gather data.
- communicate investigations and explanations.
- understand that plants and animals have life cycles that include being born (germinating), developing into adults, reproducing, and eventually dying.
- understand that each plant or animal has different structures that serve different functions.
- understand that living things depend on other living things to meet their needs.

Objectives for sustainability extension - students will:

- ask and answer questions relating to the effect of pollutants on plant growth.
- employ simple measurement tools to gather data.
- communicate investigations and explanations.
- begin to understand the concept of a “fair test.” (i.e., use of control group)
- understand that organisms have basic needs.

Lesson 1 – Introducing the Unit

When introducing the Fast Plants study, explain to students that the unit will have two goals: The first one is to follow a plant through its life cycle from the germination of a seed to the production of more seeds. The other, parallel study is to determine the effect of pollutants on plant growth.

Have students in their groups discuss the needs of the plants: the light, favorable temperature, water. They should share their thoughts with the class.

Ask what will happen if the water is polluted. Ask students what pollution is. What kinds of things might pollute the water? Possible sources of pollution might include road salt, acid rain, oil, garbage, detergents, air pollution.

How can we use some of the Fast Plants to design an experiment to see what happens when plants are exposed to these pollutants? Students in their groups should choose one of the pollutants and design an experiment to determine how it affects plant growth.

- What “pollutants” can we use?
- How can we tell whether the results we observe are actually caused by the pollutants?
- Introduce the idea of a control group as a way of making this a “fair test.” If our plants don’t grow, how can we be sure that it was the pollutant that inhibited their growth?

- Suggest that the plants they set up for the life cycle study will serve as the control group. Explain that an experiment should always use a control, to find out whether the effect observed is really due to the factor tested.
- Students should start a journal to record procedures, observations, measurements, drawings, reflections, questions, etc.

Lesson 2 – Planting the Fast Plants and the Experimental Group

Set up the Fast Plants as usual, but have each group set up an extra quad or two to be watered with the “pollutant” of their choice.

Suggestions:

Acid rain - weak vinegar solution

Oil spills - salad oil or multipurpose oil

Road salt - ice melt salt or table salt

Soapy water – laundry detergent

Lesson 3 and after – Monitoring the progress

As the unit progresses, all plants should be maintained in the same way, receiving the same amounts of light, water, etc. with the only exception being the contaminants in the water. Students should measure the heights of their plants, comparing the growth rates of the plants watered with pure water to those watered with pollutants.

Questions to explore:

Did the plants watered with pollutants grow at the same rate as the control group?

Did the experimental group:

produce flowers?

produce as many flowers?

produce as many seeds?

What conclusions can we draw?

What else do you want to know?