The Green Family

Environmental Engineering Unit

Co-Authors: Beth Watt and Misty Allmand
Contact: Beth Watt
Sixth Grade Science Instructor
Stillwater Middle School
Stillwater Public Schools

Finance Officer: Wendy Johnson
Phone: (405) 533-6430
FEI#: 73-XXXXXXX

Applying for General Environmental Education Grant

2200 S. Sangre Road
Stillwater, OK 74074

bwatt@stillwater.k12.ok.us

Daytime Phone: (405) 533-6430
Evening Phone: (405) XXX-XXXX
Fax Number: (405) 533-6324

To be implemented in two sixth-grade teams
Grant will initially affect approximately 240 students per year

Project Overview

The sixth-grade science classes at Stillwater Middle School currently implement the Carolina Biological Company's *Organisms: Macro to Micro* (OMM) curriculum module, which introduces students to a wide variety of organisms. This proposed interdisciplinary project supplements the current curriculum module with ecology-based activities related to each category of organism and teaches students about a variety of ecosystems and scientific research in Oklahoma. The culminating activity requires students to compile information from all topics to design a household that is 'environmentally sustainable' in the four areas of: ***food, water, energy, and waste*.**

Project Description

During 2006-2007 school year, Beth Watt became involved in a partnership between the School of Engineering at Oklahoma State University (OSU) and Stillwater Public Schools. In the spring of 2007, the Blazers team of teachers volunteered to pilot a prepackaged interdisciplinary mechanical engineering unit. Students and teachers were highly engaged in the unit, and greatly desired further opportunities for engineering projects. The teachers evaluated the correlation between the unit and the curriculum currently taught within their core classes, and decided that an environmental engineering unit would more effectively correlate to the science and math curriculum. After searching, unsuccessfully, for appropriate environmental engineering curricula, Beth Watt compiled an assortment of activities from many sources to develop a framework for an interdisciplinary curriculum.

The Green Family semester-long curriculum unit introduces students to the organisms studied in the OMM module, and then presents ways in which these organisms impact the environment. Students construct a micro-pond, study microorganisms in the pond, and learn about aquatic habitats, the food chain, and eutrophication. Students study the anatomy of flowering plants, learn about pollination and edible plants, and study the leaf structure and transpiration of green plants. These lessons are enhanced by studies of agricultural products. Throughout the unit, students learn about a variety of alternative energy sources, including yeast, grasses, water, and wind power, as well as Oklahoma's eco-regions, natural wildlife, and ongoing scientific research. Lastly, students study *Lumbriculus* worms, and learn about the importance of reusing/recycling, vermicomposting, and source reduction.

The Green Family design unit includes small projects to be completed throughout the course of the unit as a means of formal assessment. Each group of students will be given a hypothetical family for which to design their projects. After creating their micro-ponds in class, each group will design a pond and water purification system for their hypothetical family to use. After studying plants and insects, groups will develop an agricultural plan for their household. After studying a variety of energy sources, students will develop a sustainable energy program for their household. Lastly, after studying worms, groups will develop an environmentally friendly waste management plan for their family. The culminating activity will require students to compile information gained and designed throughout the unit to construct an approximate model of their tract of land.

The project integrates curriculum and experts from a variety of organizations and scientific research facilities, including Ag in the Classroom, Cooperative Extension for Payne County, Oklahoma Energy Resources Board (OERB), U.S. Geological Survey, Oklahoma Wildlife Department, OSU Department of Entomology and Plant Pathology, OSU Food and Agricultural Products Center, the City of Stillwater, and Oklahoma Wind Power Initiative. Many

of these entities are already assisting Beth Watt with preparation for this unit or have agreed to speak with classes about their area(s) of expertise.

The Green Family project is interdisciplinary in that students will study many of these topics in all four core team classes and the Special Education class. In Language Arts, students will gather information from a variety of primary sources, fictional, and non-fictional reading materials. In World Studies, students will study the challenges of meeting basic environmental engineering needs in developing countries. In Mathematics, students will create and interpret graphs, determine yearly and lifelong amounts of waste produced, calculate total output of energy and agricultural yield, create the blueprints for land use and house design, and learn about different types of engineering.

The Green Family unit depends upon scientific observations of a variety of single-celled and invertebrate organisms, which require student access to microscopes on a daily basis. This curriculum is unique in the fact that it focuses upon organisms that are often overlooked in most science curricula, such as molds, insects, worms, protists, and eukaryotic cells, which are all best viewed under a microscope. Unfortunately, many of the microscopes at Stillwater Middle School are broken, and the others are shuttled between science classrooms from day to day. The purchase of one new microscope will allow one group in Beth Watt's science classes to have a microscope at all times.

Goals and Objectives

The Green Family interdisciplinary environmental engineering unit meets almost all the Oklahoma Priority Academic Student Skills (PASS) for sixth-grade. In World Studies, students will learn the process skills of social studies, geographic representations, and analyze cultures. In Language Arts, students will study literature, research and information, writing, spelling, handwriting, and oral language. Through this unit, students will meet the Mathematics Process Standards of problem-solving, communication, reasoning, connections (to the real world), and representation. Students will also study the Major Mathematical Concepts of number sense, geometry, measurement, and data analysis and statistics. In Science, students will meet the Process Standards of observation and measurement, classification, experimentation, interpretation and communication, and scientific inquiry. They will also meet the sixth-grade Life Science Standards of structure and function in living systems, and populations and ecosystems.

Through this unit, students will also learn the interdisciplinary nature of engineering, types of engineering, organisms native to Oklahoma, eco-regions of Oklahoma, cooperative learning skills, research skills, and current research being conducted in Oklahoma.

Implementation

The proposed project will be implemented within the four core classes of the sixth-grade Blazers and Voyagers teams at Stillwater Middle School during the 2008-2009 school year. The design components of the project will occur collaboratively within the Mathematics and Science classes, while construction will occur primarily within the Science classrooms. The Language Arts classes will use content-based readings, and World Studies classes will incorporate geography and cultural influences on environmental engineering worldwide.

After the initial year of implementation, the unit will be evaluated by the teams and Assistant Superintendent of Curriculum for Stillwater Public Schools. At this point, the project may be further implemented within Stillwater Middle School.

Timeline

The Green Family environmental engineering unit will begin in all Blazers and Voyagers sixth-grade core classrooms in August of 2008. The unit will be completed after approximately one semester. At this point, the curriculum will be fully evaluated by all eight teachers to determine whether the unit will be further implemented within Stillwater Middle School.

Budget

The total requested budget for *The Green Family* unit is **$506.66**.

The unit will also be supplemented by a variety of funding sources: Stillwater Middle School will provide most live specimens, Wisconsin Fast Plants seeds, yeast, sugar, salt, white vinegar, growing supplies for the organisms, graph paper, pipe cleaners, scissors, construction paper, white copy paper, and clear storage containers (for non-source pollution models). The Stillwater Middle School library will provide the books *Diary of a Worm* and *The Man Who Planted Trees*. Beth Watt will purchase earthworms, radish seeds, corn and bean seeds, Brassicas, flowers, lettuce, and onions to dissect. She will also incorporate a few of her own children's books, water cycle model activity set, and educational DVD's into the curriculum. Dr. Sara Kimball (OSU Environmental Science instructor) will donate vermicomposting equipment and red worms. Plant pots and soil were purchased through a previous grant and workshops. Online simulations will be incorporated to show the activities of protists and cells.

The proposed project includes the following itemized materials:

Carolina Biological

Item	Catalog #	Cost	Quantity	Total Cost
Swift® Microscope Model M2251B	59-5502	$229	1	$229.00
		Shipping & Handling		$23.00
		Total		**$252.00**

Hasting's (Institutional prices quoted by Karen C., Book Manager, in October 2007)

Title	ISBN-13	Price
Diary of a Fly	978-006001568	$11.99
Song of the Water Boatman and Other Pond Poems	978-0618135479	$12.00
Everglades	978-0064461948	$5.24
The Fungus that Ate my School	978-0439755399	$4.49
There's a Fungus among Us: True Stories of Killer Molds	978-0531175309	$5.96
Have a Nice DNA (Enjoy Your Cells)	978-0879696146	$12.56
Cells Are Us	978-0876146361	$6.71
DNA Is Here to Stay	978-0876146385	$6.71
Code Orange ($4.87 each, *Quantity 35*)	978-0385732600	$146.10
Total		**$211.76**

Wal-Mart

Item	Total Cost
Small plastic trees, humans, houses, & misc. organisms	$15.00
Total	**$15.00**

Discovery Channel Store (discovery.com)

Item	Catalog #	Price
Planet Earth: The Future, Environment & Conservation DVD	782623	$21.95
Subtotal		$21.95
Shipping & Handling		$5.95
Total		**$27.90**

Evaluation

The Green Family environmental engineering unit will be evaluated in a variety of traditional and non-traditional ways. The most important method of evaluation will be ongoing collaboration between the instructors. Instructors will also use informal assessment to discern students' abilities to compile information to meet design challenges and communicate information. Each instructor will use a variety of informal and formal assessments to evaluate students' abilities to demonstrate their understanding within each specific content area. For instance, the eight instructors commonly use such assessments as reflection questions, journal entries, open- and close-ended questions, alternative assessments, and practical assessments within their current curriculum. From these assessments, the instructors will gain a deeper understanding of the effectiveness of student understanding, and can therefore provide new ways to reinforce the material. The instructors will also evaluate the effectiveness of the specific activities, projects/assessments, and instructional methods and adapt the materials as needed.

The items included in the budget for *The Green Family* unit are non-consumable, and will not need to be replaced. Therefore, the unit can be continued indefinitely.

Note: Beth's letter of support from her principal was not included here due to format problems.