



MINI-GRANT FINAL REPORTS

SCHOOL YEAR 2007-08



Energy Activities for the Classroom

Snohomish County PUD is committed to helping educators bring the world into individual classrooms or take the classroom out into the world.

We are excited to share with you the following success stories of our 2007-2008 mini-grant winners. Below are their stories – what they did and how their projects worked and what they'd do differently today. We provide these great teaching lessons in the hope that they will stimulate you to incorporate energy and/or water education into your curriculum.

Due to copyright laws, we are unable to produce all the materials provided to us; but you are welcome to contact the educators who developed and implemented the lessons.

The PUD thanks all the educators who brought their ideas forward for consideration as well as those individuals who gave their time to read the proposals.

Exploring Technology Project (Tech Reach) by Marilyn M. Dauer and Janette Jess

Grade Level: 7th - 8th grade
School District: Edmonds
School Name: College Place Middle School
School Address: 7501 - 208th Street SW, Lynnwood, WA 98036
E-Mail Address: dauerm@edmonds.wednet.edu
Phone: 425-431-4219

Project Description

The purpose of the project is to give middle school girls practical experience in understanding various types of energy and how those methods apply to technology. Using Legos the participants constructed various structures/vehicles that convert energy to mechanical. The girls identified the energy conversion(s) between chemical, electrical, mechanical and light.

Learning Objectives

The objectives of this project closely match the state science requirements:

- To create a system that demonstrates energy flow in systems.
- To develop an understanding of the interconnections that form a system.
- To understand how interactions within a system cause changes in energy.
- To develop skills in inquiry learning.
- To apply existing knowledge and skills in technology to design systems.

Grade Level Expectations

- Science: 1.3.2 To understand how interactions within and among systems cause changes in matter and energy.
- Science: 1.3.1 Analyze common problems or challenges in which scientific design can be or has been used to design solutions.

Materials Needed

- LEGO Science & Tech sets

Method / Design of Project

The project uses the LEGO Science & Tech sets that have 14 lessons in constructing devices which

meet a stated goal. A lesson from the aforementioned sets was selected each week and then introduced. Students were asked questions about the knowledge/ skills they already have that relate to the lesson. The basic parts of the task were discussed and then the students built an introductory unit which was then used as a beginning point to construct a more complex device.

Evaluation

The evaluation was both by the completion of the task and by having students explain the process they followed.

Challenges

Building from a simple construction to the more complex was at first frustrating and difficult for the students. As each lesson progressed acquired skills made things go more smoothly.

Successes / Strengths of the Project

It was the “hands on” approach that motivated the students to be involved. Students also learned to work together and assign different tasks, helping and correcting each other. The comments at the beginning of the session such as: “What can we build today?” or “When can we get started?” and the active engagement of the students were strong indicators of success. Another measure of the strength of this program was over 90% of the students coming back each week to continue the work with the LEGO sets.

Budget

5 sets of Lego Science and Tech set @ \$83.00 with added tax and shipping for a total of \$488.00

Watersheds

by Jan Miller and Heather Berger

Grade Level: 4th grade
School District: Edmonds
School Name: Lynndale Elementary
School Address: 7200 - 191st Pl. SW, Lynnwood, WA 98036
E-Mail Address: bergerh@edmonds.wednet.edu
Phone: 425-431-2783

Project Description

During our field trip to the Cedar River Watershed, our guides stressed the importance of reducing our use of water. When we do this, energy is conserved, habitats are sustained and the salmon life cycle works. Students were challenged to make changes in their daily water habits.

Learning Objectives

- ✦ The students understand the need for energy in all life forms.
- ✦ The students explain the life cycle of a salmon to an audience.

Grade Level Expectations

Science: 1.3.8 Understand that living things need constant energy and matter.
Science: 1.3.10 Understand that an organism's ability to survive is influenced by the organism's behavior and the ecosystem in which it lives.

Materials Needed

Transportation to the Cedar River Watershed, salmon life cycle reading, United Streaming video clip on Watersheds.

Method / Design of Project

The focus of this project was how to lower our water usage to protect salmon and other wildlife. Students prepared for the field trip by role playing the different aspects of water in the water cycle. They read about the salmon life cycle and made salmon dictionaries of new vocabulary words. During the field trip they watched a slide show preparing them for the watershed area they would tour. Several slides were focused on what would happen if the watershed was dry. After viewing the dam and discovering how energy comes from water the students created skits to teach the group lessons. For example, my group taught how a tree feeds a trout. Students were able to think through the oxygen coming from the tree, into the stream as water and then being swallowed by the trout. Upon return

from the field trip, students created posters of the salmon life cycle that shared messages of how to help salmon.

Evaluation

Informal observation of participation during the field trip, written reflections after the field trip, and formal evaluation of persuasive salmon posters.

Challenges

We were unsure of where to find watershed curriculum to provide a backbone to the instruction and non-fiction reading.

Successes / Strengths of Project

The students were able to experience the environment to gain understanding. For example, standing on a dam that divides very calm water from gushing waterfall – like water is very different than reading about it in a book. Students were able to understand how the power of the water provides the energy we use for electricity. Also, traveling through the number of checkpoints we did to enter the watershed gave students the knowledge of how protective the watershed has become to remain pure and clean. This is essential to the life cycle of salmon who must lay eggs in a clean habitat.

Budget

The transportation expenses totaled: \$811.65. The grant paid for \$653.00 of that cost.

Additional Advice for a Successful Project

Ms. Miller's classroom had to travel on a bus that was in poor working condition and could only travel at minimum speeds on the freeway. This was a charter bus that Edmonds School District had hired because all other buses were being used. This happens frequently in Edmonds and is difficult to avoid because we never know when we'll have a district bus or a charter bus. The cost for these buses is higher also.

Simple Machines

by Vicki Sargent, Penny Nichols, Siri Haugen
& Judi Lawrence

Grade Level: 4th, 5th, and 6th
School District: Edmonds
School Name: Madrona K-8
School Address: 9300 - 236th Street SW, Edmonds, WA 98020
E-mail Address: sargentv@edmonds.wednet.edu, nicholsp@edmonds.wednet.edu,
haugens@edmonds.wednet.edu, lawrencej@edmonds.wednet.edu
School Phone: 425-431-7979

Project Description

Students became experts in one simple machine by building models using K'Nex materials. Additionally, students used print and internet resources to learn about 5 different simple machines. The project culminated with student presentations where experts shared their work on one simple machine at a time so that all groups had information about all machines.

Learning Objectives

- Develop an understanding of simple machines – key ideas are components and mechanical advantage.
- Develop group learning process (jigsaw method - experts share learning with others)
- Make models of simple machines
- Where possible, connect simple machines with study of ancient civilizations

Grade Level Expectations

- Students will be able to identify/name five basic simple machines
- Students will work together to build a model of a simple machine (KNex)
- Students will identify common components of simple machines: work, effort, force, load, mechanical advantage
- Students will identify the mechanical advantage of each simple machine.
- Students will identify elements of specific machines, e.g., gears are at least two cogs with teeth, pulleys need a grooved wheel and rope/cable; pulleys may be fixed or moveable, etc.

Materials Needed

- VIDEOS - Levers, Pulleys (Corona); Simple Machines (Schlessinger)
- On-Line - Brainpop- Levers, Pulleys, Gears, Wheels & Axles, Inclined Planes, Work, Force, Gravity
- School library books on above topics; District Science kit literature from Variables kit and purchased books from grant money (see itemized budget below)
- K'Nex classroom kits with folios for building basics

Method / Design of Project

Because this was a multi-classroom grant, and because we were developing this coursework, teachers varied the approach, sequence, and outcomes. Please see attached worksheets and rubrics for specifics.

Evaluation

- + Summary chart of Simple Machines indicating type, work (what machine does), forces (effort and resistant forces) components (parts necessary to be that machine) and examples of machines, mechanical advantage
- + Brainpop quizzes (www.brainpop.com)
- + Informal observation of students building
 - Problem solving
 - Team work
 - Answering direct questions about machines from teachers
- + Quiz: name two simple machines and list their mechanical advantage.
- + Expert groups who broke out into mixed groups and presented a specific machine (jigsaw method of students teaching students). The groups are responsible for note taking. Evaluation of quality of each group's notes.
- + Self and group reflection/evaluation

Challenges

- + Small pieces – hard to manage.
- + LOTS of time practicing how to get out and put away materials.
- + Clean up takes a LONG time.
- + Need to purchase baggies for parts and plastic bins/tubs for part collection.
- + Having enough time for students to get used to building with the K'Nex, and then making the machine connections.
- + Time- we received the kits in late February. This forced a time constraint to meet the May deadline. We thus applied Jigsaw learning method in order to compress the learning. More time to explore and build with KNex, followed by simple machine research, followed by model building and presentation should be a more lengthy process.

Successes / Strengths of Project

- Students are engaged and excited due to the hands-on nature of this project. Many students (kinesthetic learners) connect to the materials physically, allowing them to access complex scientific concepts.
- The integration of science and social studies was also a strength of this project.
- Being able to see the links between content areas builds comprehension and brings authenticity to learning.
- Students can tell you the difference of 1st and 3rd class levers! Students understand the mechanical advantage of different tools.
- Students have a concrete understanding of the progress made in ancient civilizations because of the creation and advances in these technologies.

Budget

Lawrence:

Material(s) or services to be purchased	Vendor	Price (incl. tax & shipping if applicable)*
Simple Machines Deluxe Kit	K'nex	\$306 + tax
Building Big* x 3 copies	Edmonds Bookshop	\$31.50 + tax
Things That Work* x 2 copies	Edmonds Bookshop	\$56.00 + tax
Ancient Machines: From Wedges to Waterwheels by Michael Woods and Mary B. Woods x 2 copies	Edmonds Bookshop	\$52.00 + tax
TOTAL AMOUNT REQUESTED*		\$447.95

Haugen:

Material(s) or services to be purchased	Vendor	Price (incl. tax & shipping if applicable)*
Simple Machines Deluxe Kit	K'nex	\$306 + tax
Wheels, Axles, and Inclined Planes	K'nex	\$153 + tax
TOTAL AMOUNT REQUESTED*		\$499.85

Nichols:

Material(s) or services to be purchased	Vendor	Price (incl. tax & shipping if applicable)*
Simple Machines Deluxe Kit	K'nex	\$306 + tax
Building Big* x 1 copy	Edmonds Bookshop	\$10.50 + tax
Building Big DVD* x 1 copy	WGBH Boston Video	\$69.95 + tax
Things That Work* x 1 copy	Edmonds Bookshop	\$28.00 + tax
Pyramids* x 2 copies	Edmonds Bookshop	\$16.00 + tax
Cathedral* x 2 copies	Edmonds Bookshop	\$16.00 + tax
City: Roman* x 1 copy	Edmonds Bookshop	\$8.00 + tax
TOTAL AMOUNT REQUESTED*		\$494.90

Sargent:

Material(s) or services to be purchased	Vendor	Price (incl. tax & shipping if applicable)*
Simple Machines Deluxe Kit	K'nex	\$306 + tax
Things That Work* x 1 copy	Edmonds Bookshop	\$28.00 + tax
Pyramids* x 2 copies	Edmonds Bookshop	\$16.00 + tax
Cathedral* x 2 copies	Edmonds Bookshop	\$16.00 + tax
City: Roman* x 3 copies	Edmonds Bookshop	\$24.00 + tax
Mills* x 4 copies	Edmonds Bookshop	\$32.00 + tax
Castles* x 4 copies	Edmonds Bookshop	\$32.00 + tax
TOTAL AMOUNT REQUESTED*		\$494.40

Additional Advice for a Successful Project

- Having materials in a timely manner so that deep connections can be made over time.
- Presorting different K'nex into zip-lock baggies for storage and ease of clean-up.
- Magnify the parts list on each build card, labeling the color of the parts, so that students can better see what they need to get in order to build machines.

Environmental Event by Cheryl McGuire

Grade Level: 1st
School District: Everett
School Name: Jefferson Elementary
School Address: 2500 Cadet Way, Everett, WA 98208
E-Mail Address: cmcguire@everettsd.org
Phone: 425-385-7400

Project Description

Our project helped students understand how individual actions that improve the quality of water runoff in a watershed can reduce water pollution, preserve salmon habitat and improve the chances of survival for salmon. Students will learn about the watershed where our school is located and how critical clean water is to families, farmers, fish (specifically salmon), marine life and industry, as well as for power generation, tourism and recreation. Students will share the information they have learned with the community at an Environmental Fair June 5th at our school.

Learning Objectives

The learning objectives met by this project are Geography ELAR 3.1-observes and analyzes the interaction among people, the environment, and culture and Reading ELAR 4.1.1- Reading to learn new information.

Grade Level Expectations

The main grade level expectations addressed during this project are that the first grade students will read to learn new information about salmon and demonstrate

Materials Needed

In addition to the reference books and salmon puppet received through this grant, the following materials were needed for this project:

- cooking supplies and ingredients to make cookies
- boxes to use as science project display boards
- pocket chart for the Jeopardy game
- teacher produced blank book for the bilingual books

Method / Design of Project

The project was designed as a culminating activity to take place in June to celebrate and showcase

what students had learned about plants, water and the environment. Water education began this fall as an extension to the Solids and Liquids science unit. After learning about the properties of water, students used maps of our school on a sunny day to predict where water would flow off the buildings and on the ground and parking lots. They marked their predictions on their maps. Then on a rainy day they observed actual flow of water and marked it on the maps. Then they compared their predictions to their observations and the class discussed any differences. The theme of water and the environment continued through the Sand and Silt unit when students learn about the impact of sand and silt on salmon and other water life. When they studied the science unit titled New Plant our class got a worm bin and learned about how worms improve the soil's ability to absorb water and prevent runoff. Throughout the year they learned about how and why it is important to take care of the environment with a spring focus on salmon.

In May the first grade students invited a third grade class to join them in designing an Environmental Event on June 5th. This event is being planned by the students and will be a culminating event that will showcase what they have learned about the plants, water, and the environment. First grade students did science projects to display during the event. Some students wrote, performed and taped salmon puppet shows that will be shown during the event. Several students created informational posters about earthworms. "Litter Bugs" were created out of recyclable materials and stories were written about the "Litter Bugs". Both will be displayed in the library until the night of the event. Environmentally friendly cookies made by the first grade students will be served as snacks during the event.

The two classes are working together to create several games for the evening, including writing questions and answers for a Jeopardy game about plants and the environment. They are also working with cross grade partners to write and illustrate bilingual (text is in English and Spanish) counting books about litter that will be displayed that evening and then delivered to a daycare center and the ELL teacher at Jefferson. The two classes will end the evening by singing a song about the environment they are learning in music class.

Evaluation

The evaluation/assessment used to demonstrate the students met first grade learning objectives and/or GLE's are

Challenges

Challenges in implementing the project were primarily scheduling. We were unable to have the Killer Whale Tales group come to our school because by the time we able to contact them, we could not find a day that would work for our school and the group. We are trying to schedule them to come in the fall. Our other scheduled guest speaker, Russel Barsh, had to cancel because of his work demands. I was however, able to get Ms. Kagley and Mr. Tonnes (both marine biologists working for N.O.A.A.) to work with my class and help the students learn about the environment and salmon.

It was also difficult to work around the literacy block, math block and specialist times to build in time for the science extensions. In the spring when the third grade class and first grade class collaborated to

plan the details of the Environmental Event it was twice as difficult so we sometimes had the students brainstorm together and do the follow up work in their own classrooms.

Successes / Strengths of the Project

The successes and strengths of this project were many. The students loved learning about salmon and the environment. They demonstrated their enthusiasm when we began to brainstorm what we wanted to include in our Environmental Event. They had many ideas about what they felt was important for the adults to know about taking care of the environment. Students were willing to take work home to complete and often asked to work on activities for the event when they finished their assigned work.

Mr. Haney, the Librarian at Jefferson, added the following

After looking through the circulation data for the past few months, I'm thrilled to see that the books purchased with the PUD grant have been utilized a great deal with little promotion on the librarian's part. Total check-outs for these library materials in the past 3 months alone have been 58! That means 58 times someone has come to the library looking for a good-fit book on salmon, streams, and rivers, and 58 times they've walked out the door with a quality library book purchased through these grant funds. One of my favorite moments was having a 4th grader come in last week with a slightly panicked look on his face admit to me that he needed "a lot of information about salmon and trout" and he needed it yesterday, as the dreaded project was due on Friday. What a great feeling to be able to take him straight to a shelf full of new salmon and trout books at his reading level, books that I certainly would not have been able to purchase without these grant funds. Equally great was knowing that this grant was helping not just the students in a class or two, but all of Jefferson's students.

Budget

An itemized budget is listed below.

Salmon Stream	13.22
Salmon Creek	11.01
Swimmer	12.44
Salmon Summer	13.26
First Salmon	12.44
Trout & Salmon of North America	26.40
Salmon Boy	7.95
Reaching Home	28.84
Life Cycle of a Salmon	10.96
Salmon Forest	12.76
Salmon	9.56
A Salmon for Simon	9.96
Salmon Princess	13.56
Salmon	19.95
Pacific Salmon	18.95
Life Cycle of a Salmon	17.75

Life Cycle of a Salmon	15.95
Prince & the Salmon People	19.95
Salmon	10.36
Salmon	15.95
Swimming Salmon	21.72 (\$10.86 x 2)
By Lakes and Rivers	16.95
Rivers & Lakes	18.95
Leaving Protection	10.86
Rivers and Lakes	8.49
Salmon Puppets	35.90 (\$17.95 x 2)
Magic School Bus Goes Upstream: Salmon	38.50 (\$3.50 x 11)

Total \$ 499.91

Energy Awareness by Sara Seiber

Grade Level: 6th and 8th grades
School District: Marysville
School Name: Tenth Street School
School Address: 7204 - 27th Ave NE, Tulalip, WA 98271
E-Mail Address: Sara_Seiber@mssl.k12.wa.us
Phone: 360-653-0665

Description of Project

My students and I investigated energy efficiency in incandescent light bulbs and various types of fuel.

Learning Objectives

By the end of this unit, I wanted students to understand some of the impacts of using energy. I wanted them to be knowledgeable about energy conservation and be able to make critical decisions regarding various kinds of energy usage.

Grade Level Expectations

- Science 1.1.4: Understand that energy is a property of matter, objects, and systems and comes in many forms (i.e...electrical energy...chemical energy).
- Science 1.2.2: Understand how various factors affect energy transfers and that energy can be transformed from one form of energy to another.
- Science 3.1.1: Analyze common problems or challenges in which scientific design can be or has been used to design solutions.

Materials Needed

Lab-Aids Biofuels Kit (No. 39S)
Lab-Aids Modeling Biofuels Kit (No. 38)
Lab-Aids Measuring Energy Efficiency Kit (No. 206S)
Ice
Corn Syrup
Sugar
Glycerin
Extra 2 watt light bulbs
Extra 9 volt batteries

Method / Design of Project

I originally intended to complete this entire unit with my 8th grade class. However, after receiving materials I realized that the energy efficiency kit was more appropriate for my 6th grade class. My 6th graders completed this investigation first, in which they measured how much heat an incandescent light bulb gives off (compared to the amount of light it produces). My 8th graders first completed the modeling biofuels investigation, in which they modeled the chemical reactions of the combustion of various types of fuels and calculated the amount of energy and waste (carbon dioxide) each produced. Finally, my 8th graders completed a more hands-on investigation in which we made our own biofuel (ethanol) and tested the effects of kerosene and ethanol in heating a fluid, producing carbon dioxide, creating smoke, etc. With each grade we ended our units with a discussion of the pros/cons of using various types of energy.

Evaluation

For each investigation, students completed an analysis packet along with their lab. However, most beneficial to me were written reflections in their science journals and a class discussion.

Challenges

We had a few challenges in implementation, the first being time. These labs always take longer than the teacher's guide says they will, especially if we want to have any kind of an in-depth discussion. The second challenge (common when buying a kit) is that they don't often give you "extras," and my middle school students are not known for their gentleness in the lab. We did have a few things break, some of which are easy to replace and some of which are not. One other challenge is that the biofuel labs are rather sophisticated and took additional time to explain/work through with middle school students (though we did pull through!)

Successes/Strengths of the Project

My students really enjoyed this project. I saw a lot of learning happen, and I would recommend it to other teachers.

Budget

Lab-Aids Biofuels Kit (No. 39S)	\$187.00
Lab-Aids Modeling Biofuels Kit (No. 38)	\$79.95
Lab-Aids Measuring Energy Efficiency Kit (No. 206S)	\$97.00
Shipping and Handeling	\$36.40

Field Trip to the Salmon Hatchery in Gold Bar, WA by Patricia Van Hemelryck

Grade Level: 3rd-5th
School District: Monroe
School Name: Chain Lake Elementary School
School Address: 12125 Chain Lake RD, Snohomish, WA 98290-3626
E-Mail Address: vanhemelryckp@monroe.wednet.edu
Phone: 360-804-3100

Project Description

Four classes took a field trip to the Salmon Hatchery in Gold Bar as a part of our water/ salmon/ Washington State unit. We are studying the many roles water, as a resource, plays in our environment in addition to the physical properties of water. Parent chaperones/assistants encouraged participation in the learning by facilitating and encouraging discussion.

Learning Objectives

- First hand look at salmon in nature; hatchery vs. wild salmon;
- Understand the life cycle of salmon; learn about various species of salmon; learn about the hazards encountered by salmon in our waters
- Understand the importance of water as a resource through the study of salmon
- Use observation, listening, and communication skills in the process of asking questions
- Learn about the connections between salmon, water and hydroelectric production

Grade Level Expectations

Understand how to ask a question about objects, organism and events in the environment.
Apply a variety of listening and observation skills/strategies to interpret information.

Materials Needed

- Package of "Rite in the Rain" All-Weather writing paper
- 90 Clipboards

Method / Design of Project

Through a variety of activities prior and after the field trip planned, students will become familiar with the lifecycle, habitat and the various species of salmon. Activities ranged from book reading, discussions, posters, short film and guest speaker(s). We paid particular attention to the salmon's habitat (water) and its surroundings. Students engaged in games on the hazards encountered by salmon in its life's journey and a game that helps them take notice of the various attributes of the several species of salmon.

As a culmination of this unit, students were asked to share their learning in a written essay illustrated in a manner of their own choosing. They made use of the notes and answers gathered during their field trip, and their reading, recall, and discussions of material presented over the course of the unit.

Evaluation

- Observation of student participation
- Involvement in discussions and participation in field trip activities
- Detail in culminating unit project: students’ written essays and illustrations will be evaluated with a rubric developed for the project to assess student learning.
- Individual teachers kept anecdotal records for student’s participation and discussion. Projects were evaluated with individual teacher developed rubrics.

Challenges

Coordinating four different classes, with two new teachers to our school, proved to be more work than anticipated.

Since there were four different classes participating in this project, we each pursued different ways to achieve our stated objectives. I think it would have been stronger project if we had had a chance to meet and plan a joint project and perhaps organized a chance for the students to share their projects with one another.

Successes/Strengths of the Project

- The way the PUD (Sarah Dinnis) was able to work with us on a tight deadline to make this field trip experience a reality.
- Because we had over 20 parents participating in this field trip, the impact went beyond just the classes involved.
- Students and parent chaperones were thrilled by the way they were prepared for their outdoor observation regardless of weather. Students as well were pleased with the professional “field research” paper and clipboards that help set the tone for this field trip.

Budget

Material(s) or services to be purchased (vendor)	Price (incl. tax & shipping if applicable)
Bus rental (Monroe School District)	\$ 218
90 Clipboards	\$ 180
Package of “Rite in the Rain” All-Weather writing paper	\$ 50
TOTAL AMOUNT REQUESTED*	\$ 448

Because teachers have such limited amount of time and are somewhat intimidated by the prospect of writing a “Grant”, having someone like Sarah Dinnis has made it an especially “painless” process. Kudos for all her support!

Amusement Park Construction / Roller Coaster Design by Karla Marzolf

Grade Level: 3rd - 5th
School District: Monroe School District
School Name: Sky Valley Education Center
School Address: 17072 Tye, Street Building B, Monroe, Washington 98272
E-mail Address: marzolfk@monroe.wednet.edu
Phone: 360-804-2700

Project Description

Students will research and design an amusement park. After completing the preliminary amusement park design including a map and brochure students will begin constructing a roller coaster. Students will learn the principles of friction, gravity, and momentum during the roller coaster design stage.

Learning Objectives

- Students will be able to design a roller coaster using the same physics concepts used in designing roller coasters
- Students will complete several activities to learn specific principles of friction, gravity and momentum
- Students will be able to understand how gravity is the force that makes objects fall to Earth
- Students will use technology to design a brochure of the amusement park.

Grade Level Expectations

Science: 1.3.2. Understand that forces can change the motion of common objects.

Science: 1.3.1. Understand forces in terms of strength and direction.

Writing: 2.2.1. Demonstrates understanding of different purposes of writing

Reading: 2.3.2. Analyze sources for information appropriate to a specific topic or for a specific purpose.

Materials Needed

- Force and Motion Kit
- Computer
- Graph Paper
- Marbles

Method / Design of Project

1. Students begin by researching amusement parks.

2. Next, students work in teams to design their park
3. Students create rough drafts of their brochure and map
4. Students complete a final brochure on Microsoft Publisher
5. Students design a roller coaster using the Force and Motion Kit

Evaluation

1. Students are assessed on their research report
2. Students are assessed on their participation and group work
3. Students are assessed on the brochure: creativity, neatness, accuracy
4. Students are assessed on their understanding of roller coasters

Successes / Strengths of the Project

Students greatly enjoyed being able to work in groups to create the amusement park. Independently students created an amusement park brochure. Last students were given the opportunity to build the roller coaster. Students enjoyed applying the skills and knowledge they gained of roller coasters to actually manipulating various pieces together into a coaster.

Budget

Force and Motion Kit: approx. 21.95

Bridge Building by Karla Marzolf

Grade Level: 5th-7th
School District: Monroe
School Name: Sky Valley Education Center
School Address: 17072 Tye Street, Building B, Monroe, Washington 98272
E-Mail Address: marzolfk@monroe.wednet.edu
Phone: 360-804-2700

Project Description

The purpose of this project is to provide hands-on curriculum tools to inspire students to explore sustainable and renewable energy solutions to meet our future needs. Learning how to sustain and re-new energy will provide students with basic information about solar, wind, biomass, etc. The projects are designed to discuss the role of energy in various topic areas such as, advanced vehicles, alternative fuels, and energy delivery.

Learning Objectives

- Students will be able to understand how bridges have transformed our transportation system and economic growth.
- Students will gain a comprehensive understanding of the history of bridges by completing a re-search report on the computer.
- Students will be able to develop a bridge understanding the following variables:
 - length of the bridge
 - weight of load
 - effects of river current and/or ocean tide
 - effects of wind, rain, temperature, and other weather conditions
 - time and total cost to build the bridge
- Students will use geometry, physics, technology education, mathematics to build an efficient bridge design

Grade Level Expectations

Social Studies:

- The student analyzes and evaluates how people in the United States have addressed issues involved with the distribution of resources and sustainability in the past or present.

Geography:

- The student uses a spatial perspective to make reasoned decisions by applying the concepts of loca-tion, region, and movement and demonstrating knowledge of how geographic features and human cultures impact environments.

Math:

- Formulate questions to be answered to solve a problem
- Use mathematical patterns and ideas to extend mathematical thinking and modeling to other disciplines

Science:

- Understand energy is a property of matter, objects, and systems
- Analyze problems or challenges in which scientific design can be or has been used to design solutions.

Materials Needed

- Graph Paper
- Rulers
- Ink Pen
- X-Acto knife
- Wax Paper
- Bridge Building Kit including: Balsa Wood, Tacky Glue, Educator Manual

Method / Design of Project

1. Students complete a short worksheet using the Internet as their research tool to find out the history of bridges.
2. Next, students complete a second activity using the Internet as their research tool to discover types of bridges.
3. Third students go to the following website <http://www.bridgebuilder-game.com/> click on Free download Bridge Builder (2000) and begin playing. The objective of the game is to construct a bridge over water that supports the weight of a train.
4. Students are broken into groups of two/three.
5. As a class discuss all the student instructions provided in the Bridge Building Kit.
6. Students begin choosing a bridge to model their bridge after and quickly start sketching their designs on graph paper.
7. When students complete their designs the teacher verifies for accuracy.
8. From this check off point students are ready to begin building their bridge.
9. Once the bridges are complete they are tested by following these steps:
 - a. weigh the bridge
 - b. place bridge on the platform
 - c. attach a bucket onto the roadbed
 - d. add weights to the bucket
 - e. record the maximum load

Evaluation

Currently the students are in the process of building their bridges and they should be complete at the end of May. To this point students have completed all the blueprints showing the end view, side view,

roadbed, and top view and are now constructing the bridge from balsa wood. Students have learned a great deal regarding bridges and appear to look forward to the daily challenges of building their own design. Students completed all prior work and were assessed on the accuracy of their research prior to being able to begin the bridge.

Challenges

Students would rather skip the process and get straight to building the bridge.

Successes / Strengths of the Project

1. Student collaboration
2. In-depth project
3. Actively participating and solving problems
4. Technology integration
5. Greater understanding and appreciation for bridges

Budget

- Graph Paper approx. \$4
- Rulers approx. \$10
- Ink Pen approx. \$5
- X-Acto knife approx. \$15
- Wax Paper approx. \$4
- Bridge Building Kit including: Balsa Wood, Tacky Glue, Educator Manual approx. \$95

Solar Powered Cars by Bill Catey

Grade Level: 4th grade
School District: Private
School Name: St. Mary Magdalen
School Address: 8615 Seventh Ave SE, Everett, WA 98208
E-Mail Address: billc@stmarym.org
Phone: 425-385-7559

Description of Project

The fourth grade students will construct solar cars from kits after researching solar energy. The students will keep a journal of their research, hypothesis, materials, data and results. This information will be used to construct a written test to assess the students' learning and to create a class power point presentation.

Learning Objectives

- Students will research varied forms of energy, and in particular, the uses of renewable solar energy.
- Students will journal highlights of their research.
- Students will utilize and journal results of various hypothesize while constructing and testing their solar cars.

Grade Level Expectations

Science 2.1 The student knows and applies the skill and processes of science and technology.
Science 3.2 Science in the Social Context- Although people using scientific inquiry have learned much about energy in nature, much more remains to be understood.

Materials Needed for the Project

- Solar car materials included in the car kit
- Science journals
- Computers for research

Method / Design of Project

1. Students will research solar, electric, and gasoline powered cars. They will write the benefits and challenges of each form of energy in their journals.
2. Using the step by step directions provided by the solar car kit company, students will construct individual solar cars.

3. Students will write hypothesis regarding their car's performance.
4. Students will experiment with the energy the cars receive from the sun on various days. Students will list variable such as inclines, varying surfaces, and construction adjustments.

Evaluation

On-Going Assessment-During the research and recording of important points, the teacher will check the students' notebooks. The teacher will also see that individual cars were constructed according to the directions.

Culminating Assessment - The teacher will administered a test which will assess students' understanding of the methods of energy discussed, the solar powered car performance hypothesis, the results of the testing, and the variables.

Challenges

More time was necessary to create individual powerpoint presentations.

Successes / Strengths of the Project

At St. Mary Magdalen School, students are taught to be good stewards of the world. Stewardship of the world's resources is promoted throughout the curriculum. Researching energy sources and constructing solar cars as an example of renewable energy source sets the basis of understanding the various sources of energy and how they can be used wisely. During the research and recording of data stage of the solar car project the students will understand the causes and effects of each type of energy and especially the renewable aspect of solar energy. Studies done at this time in their development make an impression and impart a base of knowledge that will be used as the learning process continues in the area of energy education.

Budget

2 classroom 10 pks.	SunnySide Up	\$316.00
3 individual solar cars	SunnySide Up	\$63.00
Shipping	SunnySide Up	\$25.50
 Total		 \$404.50

Solar Powered Cars

By Karla Kenning

Grade Level: 4th grade
School District: Private
School Name: St. Mary Magdalen
School Address: 8615 Seventh Ave SE, Everett, WA 98208
E-Mail Address: karlah@stmarym.org
Phone: 425-385-7559

Description of Project

The fourth grade students will construct solar cars from kits after researching solar energy. The students will keep a journal of their research, hypothesis, materials, data and results. This information will be used to construct a written test to assess the students' learning and to create a class power point presentation.

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- Solar car materials included in the car kit
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Culminating Assessment - The teacher will administered a test which will assess students' understanding of the methods of energy discussed, the solar powered car performance hypothesis, the results of the testing, and the variables.

Challenges

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At St. Mary Magdalen School, students are taught to be good stewards of the world. Stewardship of the world's resources is promoted throughout the curriculum. Researching energy sources and constructing solar cars as an example of renewable energy source sets the basis of understanding the various sources of energy and how they can be used wisely. During the research and recording of data stage of the solar car project the students will understand the causes and effects of each type of energy and especially the renewable aspect of solar energy. Studies done at this time in their development make an impression and impart a base of knowledge that will be used as the learning process continues in the area of energy education.

Budget

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3 individual solar cars	SunnySide Up	\$63.00
Shipping	SunnySide Up	\$25.50
 Total		 \$404.50

Studying Wind Energy by Curt Chester

Grade Level: K-10th grade
School District: Stanwood-Camano Island
School Name: Saratoga School
School Address: 9307 - 271st Street NW, Stanwood, WA 98292\
E-Mail Address: cchester@stanwood.wednet.edu
Phone: 360-629-1372

Description of Project

Using a weather station installed at Saratoga School, students will monitor weather conditions. Students will study alternative forms of energy production with emphasis on wind power. Using what they learn through investigation, design and observation, students will determine if wind would be a viable alternative energy source in the region of Stanwood in and around Saratoga School.

Learning Objectives

- Students will research use of wind as an energy source in other locations.
- Students will monitor local weather conditions.
- Students will build wind machine models and place them in different locations around the school to discover the most beneficial sites for wind energy generation.
- Students will collect and analyze data, (i.e. wind speed and direction, temperature, barometric pressure, rainfall, humidity, solar radiation), from the weather station and make predictions of how much energy might be produced from the wind at a given time or season.
- Students will design, implement and analyze modifications to the wind machines for greater effectiveness.
- Students will understand and successfully use vocabulary, equipment and data related to the project.
- Students will know the relationship between weather conditions and electricity produced by wind power.
- Students will hypothesize as to the efficacy of wind generation at or near Saratoga School.

Grade Level Expectations

1. Inquiry: The student knows and applies the skills, processes, and nature of scientific inquiry.
2. Application: The student knows and applies science concepts and skills to develop solutions to human problems in societal contexts.

Materials Needed for the Project

- Vantage Weather Station
- Computers w/internet access
- Various materials for design and construction of models

Method/Design of Project

PREPARATION:

- Purchase of weather station will be split evenly between PUD and Stanwood-Camano S.D.
- Purchase of hands-on materials for student-made wind generators, paid for by Stanwood-Camano S.D.
- Installation of onsite weather station performed by school district maintenance staff.
- Weather station connected to existing onsite computer that will be used as the primary weather station.

STUDENT INVOLVEMENT

- All students will research or learn about wind through reading material, video resources, Internet sources and visiting speakers.
- Students analyze and evaluate and propose possible locations for placement of onsite weather station.
- All students will record observations about local wind and weather conditions
- Students will build a longitudinal database of local weather conditions
- Students will analyze and record local wind speeds, durations, sustained average wind speeds and gusts
- Students will predict if wind might be a useful local energy source.
- Students will study and evaluate wind generation devices in current use around the country
- Students will design and build wind machines
- Students will monitor and measure potential power generation.
- Students will monitor and record data provided by the weather station. Middle school and high school students will correlate weather data with power generation data.
- Students will experiment with using power generated via wind machines and propose alterations to wind machine design and placement.
- Middle school and high school students will extrapolate data to predict how much wind energy would be needed to fully serve Saratoga school for a day, a month and a school year.
- Students will create and present their findings to parents/community/etc.

Evaluation

Learning was evaluated based on data collection, written evidence of research, ability to accurately answer questions about weather data, wind energy and power generation. Successful design of wind machines, and logical written conclusions during all phases of this project will provide evidence of learning. Classroom presentations by students also provided further evidence of learning.

Challenges

Since we are a Parent Partnership Program, our students only come to school one day a week. This presented a challenge to keep the project in focus and to complete different phases in a timely fashion.

- We did not anticipate how difficult installing the weather station would be. While this was an initial challenge, it provided a unique learning opportunity. The students learned a lot about

proper installation; including choosing the best site that would be free from obstructions and not effected by radiant heat from the ground and/or structures.

- We initially planned to purchase the weather station directly from the manufacturer, Davis Instruments. They would not accommodate us by splitting the invoice to make it possible for the PUD grant to pay half and our school district the other half. Fortunately, we found a very helpful vendor at WeatherShop.com. They were very helpful and actually gave us a better price than direct purchase from Davis.
- While all our school computers are Macintosh, we found that the Mac software did not have all the features we wanted (e.g. UV sensors). In addition, the Mac software is not compatible with newer Intel based Macs. It may be worth considering purchasing a basic PC to use as a dedicated system to run the Weatherlink software.

Successes/Strengths of the Project

- ✦ Students were actively engaged in every part of the project. Their sense of ownership was accentuated by the authenticity of the activities they participated in.
- ✦ The project is ongoing. We are just beginning to see the value of having a locally installed weather station. Next year, and in years to come, we will continue to expand the scope of how we incorporate weather study and analysis with our science classes here at Saratoga.

Budget

Items included in PUD grant proposal (PUD paid ½ the cost)

- 1 Wireless Vantage Pro2 Plus = \$895
- 1 Mounting Pole Kit = \$31
- 1 Mounting Tripod = \$58.50
- Total Cost = \$984.50

Items not part of the PUD Grant

- Weatherlink software = \$159
- Misc. supplies and materials = \$200

Additional Advice for a Successful Project

- Thoroughly investigate possible locations for mounting a weather station.
- Determine what software will be used to collect data
- Search the internet for Do-It-Yourself wind generators, lessons and plans.

Rivers & Hydropower Project

by Liz Chester

Grade Level: 6th Grade
School District: Stanwood Camano Joint School District
School Name: Stanwood Middle School
School Address: 9405 - 271st St. NW, Stanwood, WA 98292
E-Mail Address: echester@stanwood.wednet.edu
Phone: 360-629-1350 ex 3107

Project Description

Our 6th grade science curriculum has a unit on “Energy, Machines, and Motion”, which completely omits hydropower. Our Social Studies curriculum is “Ancient River Civilizations”. I begin right here at home with our own River Civilization, which is infused with hydropower and curriculum rich with examples of abundant food supply (salmon), flooding problems, and rivers as a source of energy.

Learning Objectives

- ✦ Students will understand, first hand, how electricity is generated from water.
- ✦ Explain the relationship between the river systems and energy systems.
- ✦ Describe the process whereby the kinetic energy of the river is also potential energy and is transformed into electrical energy.
- ✦ Describe how the parts of the river system and hydropower system interconnect and influence the salmon life cycle.
- ✦ Develop inquiry skills based on models, observations, predictions, and investigations.

Grade Level Expectations

Science: 1.1.4 Understand that energy is a property of matter, objects, and systems and comes in many forms.

Science: 1.2.1 Analyze how the parts of a system interconnect and influence each other.

Materials Needed

To carry out the unit/project, we needed Make Your Own Hydropower kits for students to assemble and transportation to Jackson Hydroelectric Project for students to see a working hydropower generator. The PUD grant purchased those items/services.

Method / Design of Project

1. Students will have studied river systems all year, including deltas, estuaries, and flooding problems.
2. Our science unit on Energy, Machines, and Motion omits hydropower, which I believe to be pertinent to Washington State students and have searched for curriculum, models, and experiences

to fill this gap. Model kits will allow students to build a model of a hydro-generator and watch it work to produce enough electricity to light a led light.

3. Students will tour Jackson Hydroelectric Project to see an actual generator and the entire system. They will have inquiries to investigate while there.
4. Students will gather information about the pros and cons of dams for flood control and power generation. They will compare the older and newer technology of dams and generators in regards to the amount of electricity produced and the impact on the environment, using dams in Washington and the Aswan Dam in Egypt and the Three Gorges Dam in China.

Evaluation

- a. Participation in building the model hydro-generators and whether they function properly (performance based assessment).
- b. Explain the parts of the generator system and how each works.
- c. Completion of the inquiries on the field trips.
- d. Demonstrate understanding of a power (PUD) bill by choosing the appropriate type of graph and graphing the distribution of their power dollar using a pie chart, bar graph, etc.
- e. Presentation of arguments and data comparing the efficiency and cost of electricity produced by Washington State dams to the Aswan and the Three Gorges dams.

Challenges

For the most part, the project went smoothly. We were able to participate in a PUD Hydropower Workshop before we began the project as outlined. I felt that was a boost and kick-off for the unit, and aroused the students' interest. Students became very involved in assembling the hydropower models, but were unable to produce electricity. Their failure led to some great trouble-shooting and problem solving activities. We felt that 8 students per kit was a detriment to the optimal learning, however. Next year, we will aim for 4-5 students per kit.

We were not able to get to the salmon part of the plan as we just ran out of time. Students are currently researching the pros and cons of a dam and their environmental impact. They are learning about how salmon are affected through their research. The fall and spring weather haven't been conducive to outdoor field trips. I would like to repeat this unit next year and add the salmon element in the fall.

Successes / Strengths of the Project

The project was successful in engaging students in the learning process. The hands on experience with the Hydropower Workshop and building the models were tremendously engaging. Our school had no equipment to be able to replicate this experience. Due to their effectiveness, we plan to purchase more hydropower models for next year. Some students discovered how electricity gets to the outlets and switches in their walls! Throughout the unit, students discovered many interesting and sometimes shocking bits of information about hydropower in our state.

Students were extremely interested during the field trip to Jackson Hydroelectric Project in Sultan. They asked probing questions and really stretched themselves mentally. When we returned from Jackson, they had some new hypothesis for why their models did not work and tried a bit more troubleshooting. One group was able to get their model to produce electricity! Their turbines were not spinning the rotors fast enough.

Budget

We spent \$290 on 4 hydropower models and \$210 on transportation from Stanwood to Sultan.



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