County Implementation Award Program (CIAP) Math and Science Lesson

Unit Title: Energy

Lesson Title: Natural Energy Device

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Grade Level: 4/5

Time Frame: 2-3 weeks (Twice a week)

Targeted Standard(s):
4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

CCSS.4.MD.A.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money.
CCSS.5.NBT.B.7 Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

Short Description of Targeted Phenomenon:
Create a problem that the students need to solve. My problem:
You are going camping and you want to make s'mores. We have had several fires, so open flames are not allowed at your campgrounds. You need to come up with a way to make s'mores without flames or electricity. You need to use a natural energy source. You may not spend more than $6.50. Your device must stand freely and must be enclosed so nothing can get to the food. (I also gave the students an option to cook a simple pizza with bread or English muffin.)

Three Dimensions of NGSS
Science & Engineering Practice/s (SEP): Constructing Explanations and Designing Solutions

- Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.
- Apply scientific ideas to solve design problems. (4-PS3-4)

Crosscutting Concept/s (CCC): Energy and Matter

- Energy can be transferred in various ways and between objects.

Influence of Science, Engineering and Technology on Society and the Natural World

- Engineers improve existing technologies or develop new ones.

Disciplinary Core Idea/s (DCI):
PS3.B: Conservation of Energy and Energy Transfer

- Energy can also be transferred from place to place by electric currents, which can then be

used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.

PS3.D Energy in Chemical Processes and Everyday Life

- The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use.

ETS1.A Defining Engineering Problems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared based on how well each one meets the specified criteria for success or how well each takes the constraints into account.

ETS1-1

- Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Language Supports: Energy, energy efficient, non-renewable resource, renewable resource

Materials Needed: cardboard, foil, plastic wrap, black construction paper, thermometer, newspapers, clear tape. (Other items may be needed. It depends on the structures that your students choose to create. My students used jars, cans, mirrors and magnifying glasses as well.)

Objective(s): Students will be able to:

1. Create a device that uses natural energy to cook a food item.

2. Test that device and make changes, if needed, to make the device work.

3. Present their device to the class explaining how the device works and how the energy is transferred.

How Math and Science concepts/skills/practices were integrated in this lesson:
In order to create their device, they will need to measure their materials and determine how much of each material they need. Then they will have to add up the cost of the material to determine the cost of making their device.

Possible Challenges /Misconceptions: Many students may not think it is possible for them to create their own device using natural energy. They may struggle with the dimensions they need to create for their project. They may struggle with creating a device under the budget.

Formative Assessment: They will present their projects to the class. They will use their journal to assess their device and record its effectiveness. They will record any changes they made and the effectiveness of those changes.

Lesson Opening	
Teacher Actions	**Student Actions**

Teacher asks the following questions: You are going on a camping trip. You want to make s'mores. Due to the fire danger, you are not allowed to have an open flame. There is also no electricity. How are you going to cook your s'mores? What forms of natural energy do you have available? How can you use that/those forms of energy?	Students discuss their answers to the questions in small groups.
Lesson Introduction	
Teacher Actions Explain to students that they will be building their structures in small groups. They will need to brainstorm ideas and create a sketch.	**Student Actions** Listening to instructions and asking questions.
Body of Lesson	
Teacher Actions The teacher will provide a variety of materials in order to create their models. A graphic organizer will be provided as well as technology to research ideas. Teacher will create a table of the cost of each item.	**Student Actions** Students will research, draw a blueprint, and create a device to cook their s'mores. This device must contain a natural energy source. They must test and revise their device and document any revisions. Students will calculate the total cost to create their device.
Lesson Closure	
Teacher Actions Assess the projects and presentations. The teacher will work with presentation skills (eye contact and level of voice). The teacher will set up a schedule for presentations outside of the classroom.	**Student Actions** Students will present results to their classmates and teacher. Later, they will have the opportunity to present to a younger grade.
Summative Assessment: The summative assessment will be there project, presentation, and their journal entries.	
Other Teaching Resources: Attached graphic organizer.	
Lab Safety: N/A	
Extensions (if any):	

What materials are needed? You have $6.50 to spend. What is the total cost of your materials?

1. _____ $_____

2. _____ $_____

3. _____ $_____

4. _____ $_____

5. _____ $_____

Here are the items my students needed and the values I gave them:

Magnifying Glass - $3.65 each

Mirrors - $1.28 for 2 mirrors

Cardboard - $0.24 per piece

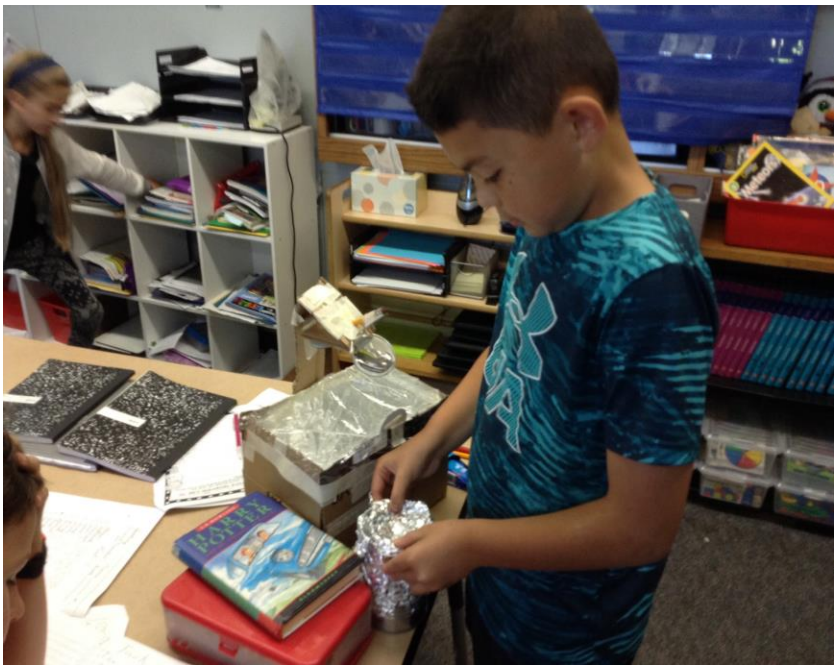
Aluminum Foil - $0.32 per foot

Plastic Wrap - $0.22 per foot

Jar - $2.00

Surprisingly many of my students chose to use glass jars. These students thought a blacked-out jar would keep in heat and cause the s'more to cook.

The jar did not work, so they created a new model. (I did not have them calculate the cost of these items.)



Some other examples of what the students created.