the CEED

THE CENTER FOR ENERGY EFFICIENT DESIGN

What Should I Wear Today?

Grade Level	2nd Grade	**Subject**	Science

Objective(s):
The student will

-create a simple experiment to prove/or disprove that dark colors absorb heat and light colors reflect heat
-measure temperature using a Fahrenheit and Celsius Thermometer
-Construct a bar graph to record their data
-realize the sun's heat can be used for energy

SOL Addressed:
2.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
a) observations and predictions are made and questions are formed
e) length, volume, mass, and temperature are measured in metric units and standard English units using the proper tools
h) data are collected and recorded, and bar graphs are constructed using numbered axes
g) conditions that influence a change are identified and inferences are made
l) simple models are designed and constructed to clarify explanations and show relationships

K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool

K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs

Materials Needed Per Class of 30	**12 or more clear plastic containers (enough that each group has two)** **1 large teaching thermometer** **16 or more thermometers showing Celsius and Fahrenheit (one for each plastic container)** **Dark plastic trash bags** **White plastic trash bags** **Masking tape** **Optional: different types of light and dark materiel (felt, cotton, linen, leather)** **Graph paper**
and	
Prior Knowledge	**Ancient Egyptians wore light colored clothing to adapt to their hot environment** **Students should know how to read a Celsius and Fahrenheit thermometers**

<table>
<tr><td>Ways to differentiate this lesson plan</td><td colspan="2">

EXTENSION for Higher Level Learner

Have the student use different types of material to cover their container. Did the materiel make a difference in how much heat was absorbed?
Which holds heat the longest, Air or water? Include a small container of water in the larger plastic container and take the temperature of both air and water after the experiment and then take it an hour later.

MODIFICATIONS
-Cover all containers with black or white trash bags
-Do experiment as a class project covering only two containers to leave in the sun

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<tr><td>Introduction/ Anticipatory Set</td><td>Anticipatory Set: In our study of Ancient Egypt we learned some of the ways the ancient Egyptians adapted their clothing to their hot environment.

Questions to ask students:
Think/Pair/Share tell your partner how ancient Egyptians adapted their clothing to their hot environment. Call on some students to share their partners answer.
Why would it keep them cool to wear light colored clothing?
How do you know this is true?
If wearing light colored clothing helped keep them cool, what color would you wear when it was cold? T/P/S
How could you prove this was true?</td><td>Introduction:

We have been told that wearing light colored clothing helped Ancient Egyptians keep cool in their hot environment, but how do we know this is true?

Give students the opportunity to share their ideas with the class.

How could we prove it?</td></tr>
<tr><td>Guided Practice</td><td colspan="2">Today we are going to do an experiment to try and prove that light colors reflect heat.
What does reflect mean? What does absorb mean?
What can we use to tell how hot or cold something is?
Go over thermometers and review how to read them.

The students will make houses and cover them with either light or dark materiel. Let the students come up with the idea of putting the thermometers inside the houses and putting the houses in the sun.
How will we know if the temperature changes? Let the students brainstorm ideas. They should eventually come up with the idea of taking the temperature inside the house before they put them in the sun and then record the temperature after they have been in the sun for several hours.

Pass out paper to make their predictions on and graph paper to record beginning temperature and ending temperature.</td></tr>
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Independent Practice	Let each team come to the front to get the materials that they need. If you are letting them decide what materiel to use for their roof let them do that now. After making their houses and recording their beginning temperature let them take their houses outside and decide the best place to put them for several hours. (Could make the houses one day and put them in the sun the next day) After a couple of hours get the houses and record the ending temperature. Have students finish their bar graphs and predict how they think their results will compare with the other teams. Teacher should make a chart on the board so every team could see each other's results.
Closure (Summary of Lesson)	After doing this experiment was the Ancient Egyptians right to wear light colored clothing to adapt to their environment? How could we use this information to adapt to our environment? Could you use the information you collected with this experiment to heat a house? Talk about Solar energy and read the book **Solar Power** by Christine Peterson.
CEED Building Application/ Sensor Data	Go to the CEED dashboard. http://dashboard.intellergy.us/ceed/index.php - Have students find all of the solar collectors. How many are there? What color would you expect the solar collectors to be? - -Go to Solar Energy tab. Look at all the solar energy collectors and discuss how much energy they are producing. -Click the more numbers tab and look at the daily energy scale. Why would it peak at certain times of the day? Look at weekly tab. Why would certain days generate more energy? -If possible arrange a field trip to the Franklin County CEED building in Rocky Mount, VA to view the solar collectors.
Assessment	TTW informally assess the student's participation, class discussions, and completed temperature, graph and predictions page.

INQUIRY LEARNING RESEARCH PROCESS GUIDELINES

The following table is just one guideline to use for developing your own inquiry materials. The seven steps in the Learning Research Process include not only how people learn but also how research is conducted. The heart of the design, the three-stage learning cycle of exploration, concept invention or formation, and application is embedded in the middle. In addition to these three stages, this design takes into account that learners need to be motivated to spend the time required for understanding complex subjects and that learners need to build this new knowledge onto prior knowledge. These are similar to the 5E and 7E learning models.

The Learning-Research Process

Steps in the Learning-Research Process	7E Equivalent	Component of the Activity
1. Identify a need to learn.	Engage	An issue that excites and interests is presented. An answer to the question *Why?* is given. Learning objectives and success criteria are defined.
2. Connect to prior understandings.	Elicit	A question or issue is raised, and student explanations or predictions are sought. Prerequisite material and understanding is identified.
3. Explore	Explore	A model or task is provided, and resource material is identified. Students explore the model or task in response to critical-thinking questions.
4. Concept invention, introduction, and formation	Explain	Critical-thinking questions lead to the identification of concepts, and understanding is developed.
5. Practice applying knowledge.		Skill exercises involved straightforward application of the knowledge.
6. Apply knowledge in new contexts.	Elaborate and Extend	Problems and extended problems require synthesis and transference of concepts.
7. Reflect on the process	Evaluate	Problem solutions and answers to questions are validated and integrated with concepts. Learning and performance are assess

Hanson, D. (2006). POGIL Instructor's Guide to Process-Oriented Guided-Inquiry Learning. Lisle, IL: Pacific Crest