Michael P. McConnell

Mandatory 5, Option 2: Applied Math Project

Solar Power, Powers Our School

Integration of Content and Process

Amphitheater Public Schools have installed solar arrays at all 20 schools. Each school has access to a solar website that illustrates how much solar energy is being produced. Early projections are that 90% of our district energy needs will be generated by the solar arrays.

To gauge students' level of understanding and interest in the solar energy I taught a mini-lesson in early February. I introduced the students to the solar website. Students analyzed and evaluated the data. I asked students to determine which day, week, and month produced the most solar energy. Reading the solar energy graph wasn't all that difficult for the students. The questions that students generated will guide the Applied Math Project: **Solar Power, Powers Our School**

Questions from our students:

Why there is more solar energy made during the summer?

Why is their more energy at lunch time?

Why do some days produce more or less energy than other days?

Our students will continue to access, analyze and evaluate the solar data has part of the daily morning routine. This will continue throughout the school year even after the Applied Math Project comes to completion.

Statement of Purpose

Topic: Students have been exposed to the solar energy website dashboard and they now have questions. Students will learn about length of day, seasons and angle of the sun.

Outcome: Students will read graphs, create graphs, analyze data, evaluate data and draw conclusions based on data provided from the solar website as well as data they students collect.

Developmentally Appropriate: Students are naturally curious about the world around them. We have placed large solar arrays on the playground and around school, which have leads to many questions from students, parents and the community. This is a great opportunity for students to learn about solar energy and use math skills while engaging with real time data. This solar arrays are now part of their world. It is important for students to know what they are and what they do.

Math Content: Students will be evaluating and analyzing real time and historic weather data. They will be creating graphs and using data to explain energy production over weeks, days, and months._

Title: Solar Power, Powers Our School

Length

The Applied Math Project; **Solar Power, Powers Our School** will take place over five lessons (days). Each lesson will last approximately 45-60 minutes. These are integrated lessons that will include; Science, Technology, Engineering, Math, English Language Arts and Social Studies. Students will engage in read-aloud stories, listening centers and art projects that are related to the sun.

Grade Level

The Applied Math Project; **Solar Power, Powers Our School** has been developed using the Arizona College and Career Ready Standards for First grade.

Arizona College and Career Ready Standards

Math

1.OA.C.5. Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).

1.OA.C.6. Add and subtract within 20, demonstrating fluency for addition and subtraction within 10.

1.NBT.A.1. Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.

1.NBT.B.2 Understand that the two digits of a two-digit number represent amounts of tens and ones

1.NBT.B.3. Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.

1.MD.A.2. Express the length of an object as a whole number of length units by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. *Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.*

- *1.MP.5.* Use appropriate tools strategically.
- *1.MP.6.* Attend to precision.

1.MD.B.3. Tell and write time in hours and half-hours using analog and digital clocks.

1.MD.C.4. Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

Science *Arizona has not adopted the Next Generation Science Standards

S1 C2 PO 2. *Participate in guided investigations in life, physical, and Earth and space sciences.*

***S1 C2* PO 3**. Use simple tools such as rulers, thermometers, magnifiers, and balances to collect data (U.S. customary units).

***S1 C2* PO 4.** Record data from guided investigations in an organized and appropriate format (e.g., lab book, log, notebook, chart paper).

***S1 C4* PO 1**. Communicate the results of an investigation using pictures, graphs, models, and/or words.

S1 C4 *PO 2.* *Communicate with other groups to describe the results of an investigation.*

S3 C2 PO 2. Describe how suitable tools (e.g., magnifiers, thermometers) help make better observations and measurements.

***S6 C2* PO 1.** Identify evidence that the Sun is the natural source of heat and light on the Earth.

S6 C2 PO 3. Describe observable changes that occur in the sky, (e.g., clouds forming and moving, the position of the Moon).

S6 C3 PO 1. Identify the following characteristics of seasonal weather patterns:

- temperature
- type of precipitation
- wind

S6 C3 PO 2. Analyze how the weather affects daily activities.

English Language Arts
Ask and answer questions about key details in a text. **(1.RL.1)**
Identify the main topic and retell key details of a text. **(1.RI.2)**
Ask and answer questions to help determine or clarify the meaning of words and phrases in a text. **(1.RI.4)**
Use the illustrations and details in a text to describe its key ideas. **(1.RI.7)**
Identify basic similarities in and differences between two texts on the same topic. **(1.RI.9)**
With prompting and support, read informational texts appropriately complex for grade 1. **(1.RI.10)**
Write informative/explanatory texts in which they name a topic, supply some facts about topic. **(1.W.2)**
With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose. (Grade-specific expectations for writing types are defined in standards 1–3 above). **(1.W.4)**

Social Studies
S4 C10 PO 2. Identify resources that are renewable, recyclable, and non-renewable.

Technology
S1 C1 PO 1. Evaluate information to generate ideas.

S1 C1 PO 1. Use digital creativity tools to develop ideas and create a project.

S2 C1 PO 1. Communicate with others as a whole class using digital tools.

S3 C1 PO 2. Explore information and online sources.

Essential Questions

Why do we have large structures call solar arrays on our campus?

What do solar arrays do?

What is solar power?

How do we know what when solar power is collected?

Objectives

The students will observe, document and analyze their shadow at hour intervals.

The students will analyze and evaluate solar data from the solar energy dashboard.

The students will graph, analyze and evaluate solar collection data.

The student will use unifix cubes or pattern blocks to model the results of the graph.

The students will use data to compare and analyze, length of shadow and solar collection peak times.

The students will record data in their math journals.

The students will determine which classroom items need electricity.

Procedures and Methods

Lesson 1

Materials

- Science Journals
- Pencils
- Chart Paper
- Sidewalk Chalk
- Camera
- Solar Energy Collection Data webpage
- T-Chart

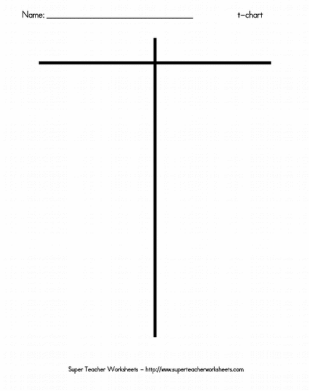
Engage:

While the students are out of the room I will turn off the lights and unplug all the power sources in the classroom.

Class discussion #1: We will discuss and document all the things in our classroom that use electricity.

- Lights
- Computers
- SMARTBOARD
- Listening Center
- Radio
- Air Conditioning
- Refrigerator

Class discussion #2: We will discuss and document how different our day, our class, and our learning will look, sound and feel without electircity. The teacher will create a T-chart and document students ideas. What needs electrcity and what does not



Lesson 2

Explore:

Students will mark their shadow every hour (8:00-1:00) from a constant point. Using sidewalk chalk, students will write their name (constant point). Every hour students will stand on their name and their partner will mark the top of their shadow. After students mark their shadows at 1:00, they will record their data in their math journal, by drawing a picture. Our 5th grade buddy class will help measure our shadows and record the data in our math journals.

Lesson 3

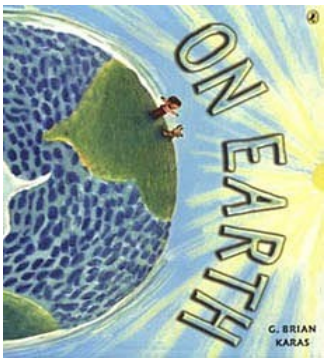
Explain:

Graph one students shadow data and notice the changes in the shadow throughout the day.

What did we notice about our shadows throughout the day yesterday?

Why did the length of our shadows change?

Read aloud “On Earth” by G. Brian Karas. This book explains earth’s orbit, rotation and tilt.



Use a globe and a flashlight to illustrate the concepts in the book.

Lesson 4

Elaborate:

Compare and analyze shadow data and solar collection data using the Solar Dashboard.

https://minisite.alsoenergy.com/Dashboard/2a56697350656d4446426b4b772b71453d

What patterns can we identify? What does our shadow look like when solar energy collection is at it's highest and lowest? Where is the sun in the sky at these times?

Lesson 5

Evaluate:

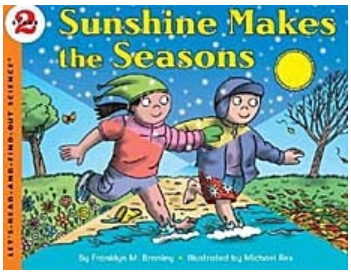
Students will communicate their understanding of the solar arrays. While in the computer lab students will write facts sheets about the sun, shadows and solar energy. Students will add pictures to their writing.

As a class we will create a feature story for the school news to be recorded and broadcast to the school.

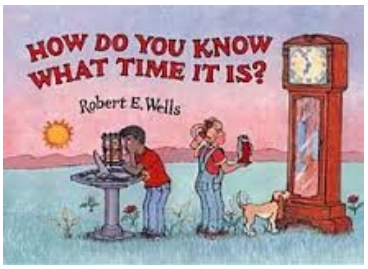
Extension to the Applied Math Lesson-In coming weeks we will look back to find high and low points on the Solar Dashboard. We will use the website: https://www.timeanddate.com/weather/usa/tucson/historic to see what the weather was like on that day and make connections to the weather and the solar output.

Additional Extensions:

Children's Literature:



"Sunshine Makes the Seasons" explains how the rotation of the earth creates our seasons.
Franklyn Branley Grades: Kindergarten - 3rd grade



"How Do You Know What Time It Is?" Explains the nature of time, its importance, and its measurement, exploring seasons, months of the year, and calendars. Robert E. Wells Kindergarten-3rd grade

Math-Telling Time:

At Innovation Academy we will have a Human Sundial that is registered with the North American Sundial Society. Students can stand on the month to determine the time.

Engineering: Students create a sundial

Music:

“You are My Sunshine”

You are my sunshine, my only sunshine
You make me happy when skies are grey
You never know, dear, how much I love you
Please don't take my sunshine away.

“Oh Mr. Sun”

Oh Mr. Sun. Sun. Mr. golden sun. Please shine down on me.
Oh Mr. Sun. Sun. Mr. golden sun. Hiding behind a tree.
These little children are asking you. To please come out so we can play with you.
Oh Mr. Sun. Sun. Mr. golden sun. Please shine down on, please shine down on,
Please shine down on me!

Art:

Sun Art-Students use orange and yellow squares to make AB patterns.

Exploration:

The students will investigate the solar powered flower. This will lead to a discussion about battery storage or solar power. We will take a trip to the battery room.