Chapter 4

Rolando Argumedo: Solar Power Investigation

Rolando Argumedo, Jr., or RJ has been an educator for 12 years with the Chicago Public Schools. He has taught Literacy and Science in grades 5-8. RJ is a HUGE baseball fan, as he roots for the Cubs and the Yankees. He is also an avid theatergoer and a wannabe New Yorker. You can find him on Twitter @BWAYCHI.

Solar Power Investigation

Grade Level: 6th

Content Area Topic: Energy

Content Area Standard(s):
MS-PS3-2: Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

Science & Engineering Practices:
- Planning and carrying out investigations
- Analyzing and interpreting data

Learning Objective(s):
- I can investigate factors that affect solar panel output.
- I can analyze and interpret data to determine the most effective solar panel orientation [or position(s)].

Suggested Time Allotment: 60 minutes

Sequence in Learning:
Prior to the solar polar investigation, students completed an investigation on wheel alignment, aerodynamic drag, and front-wheel and rear-wheel drive. After this investigation, students began to sketch their solar power cars along with developing a material list. Finally, students built, tested, and raced their cars.

Materials & Resources Needed:
- Solar Panels
- Voltmeters
- File Folders
- Transparencies
- Protractors
- Student Sheets
- Chart Paper

Lesson Activities & Sequence:
- The teacher will show students a solar panel. Note: This is the same panel students will use later in the activity.
- Students will share where they have seen solar panels around them.
- The teacher will show students three real world examples where solar panels were used to generate energy.

- The teacher will explain the investigation to students. Teachers will explain what a voltmeter is (a tool for measuring electric potential in volts). Students will use a voltmeter to measure the energy output of the solar panel, which will be orientated in several different positions (e.g. parallel to the ground; angling towards the sun; 2/3 covered using the file folder; 1/3 covered using the file folder; and covered with the transparency). Students will document their data using a Student Sheet. Important Note: Inform students to set the voltmeter to the DCV 20 setting.
- Before testing the solar panels have students make a prediction on which solar panel orientation will have the greatest energy output and the least energy output.
- Grouping: Students will work in groups of two; however, they select a new partner for this investigation. Note: For every new investigation, students must select a new partner. Thus, if two students worked together during the wheel alignment investigation, then they cannot work with each other again.
- Take students outside to test their solar panels.
- Once back in the classroom, students will answer the two analysis questions on their student sheets.
- As students are completing these questions, call each group up to write their results for the solar panel orientation that produced the greatest and least output on the "Class Results" anchor chart.
- Next, discuss the results with the students. What did they notice? Which orientation produced the greatest output and why? The least and why? Were your predictions correct? How can we use this data going forward? How will this investigation influence your design?

Proficiency:
Students will be assessed through collaborative conversations. Students will be engaged in peer-to-peer and classroom discourse centered on factors that affected the energy output along with analyzing and interpreting their data. The next activity, sketching their solar powered cars, will reinforce these learning targets, as the teacher will view how students orientated their solar panels on their sketches.

Feedback

Teachers As Learners:
The lesson had a preview, which showed how it fit into the larger context of the unit
The preview included visuals (e.g. a real solar panel and how solar

panels have been used in real life)
The lesson was engaging since it was hands-on and collaborative

Elements of Pretty Good Practice:
- The lesson connected to an authentic application (designing a solar powered car)
- The teacher gave students time to ask questions and allowed other students to answer the question or figure out the answer themselves

Modifications and Adaptations:
- Connect to an energy unit and different renewable and non-renewable sources
- Learn about history of solar power development
- Scavenger hunt of different uses of solar power in the community

Questions Arisen
- How does the solar panel work?
- What's the faulty logic in powering a solar panel with a non-renewable source?
- How to design a controlled experiment using solar panels?

Bibliography:
2014. Solar power-up: Solar panel investigation. Peggy Notebaert Nature Museum. Modified by Rolando Argumedo, Jr.

Appendix A: Student Sheet

Name:_____ Date:_____

Solar Power-Up Lab: Solar Panel Investigation Student Sheet*

Learning Targets:
I can investigate factors that affect solar panel output.
I can analyze and interpret data to determine the most effective solar panel orientation [or position(s)].

Materials:
Solar Panel Voltmeter File Folder Transparency Protractor Student Sheet

Time of Day:_____ (AM or PM)
Location:_____

Data Table

Solar Panel Orientation (Position)	Volts	Notes
Parallel with the ground		
Angling towards sun (Angle Measure: _____)		
2/3 covered with file folder		
1/3 covered with file folder		
Covered with clear plastic		

Analysis Questions:

1. Which orientation (position) of the panel had the greatest output and why? The least output and why?

2. How will the data obtained from this investigation influence your solar power car design?

*Source: Solar Power Up, Peggy Notebaert Nature Museum, 2014, Modified

Solar Panels

Where have you seen solar panels?

Solar Panels In Use…

Appendix C: MSU-Wipro Urban STEM Fellows In Action