

Hurray! Another Sunny Day Report

SUMMARY STATEMENT

The solar project Hurray! Another Sunny Day provided experiential opportunities in solar energy concepts for 4-6th graders in all Ledyard, CT elementary schools: Juliet Long School, Ledyard Center School, and Gallup Hill School. It was introduced in the year-long afterschool Aerospace Adventurers aerospace science enrichment program. It is designed to motivate students in STEAM (SCIENCE, TECHNOLOGY, ENGINEERING, ART, MATH) content and through hands on activities, extend concepts within the Ledyard Schools curriculum.

Aerospace Adventures took place on school premises, it is an afterschool program led by a current and a retired Ledyard educator who are both familiar with the science educational standards. 40 students participated.

A review of local, state and National Science Frameworks (NGSS) tasks students with the Essential Question: What is the role of energy in our world? In his [joint address to Congress](#) in 2009, President Obama stated that: "We know the country that harnesses the power of clean, renewable energy will lead the 21st. century." Towards this end, it is imperative that our students at an early age grow up with this mindset and cultural emphasis. With an emphasis on solar renewable energy and electricity, the Aerospace Adventurers program addresses the goal of exploring, experimenting, and promoting solar energy as a renewable source of electricity. The connection to planetary rovers such as Spirit and Opportunity, space probes, and satellites such as the International Space Station were discussed.

Students see solar voltaic technology increasingly around us in our calculators, night lighting, and roof installations. Foundational knowledge was established with hands-on activities with photovoltaics. The NGSS lays out the need for cross-cutting concepts such as **Interdependence of Science, Engineering, and Technology**, emphasis on core concepts such as energy transfer, and the integration of science and engineering practices. In 4th grade, electricity as a content area focuses only on battery use with circuits and grade 8 focuses on magnetism. Ledyard students need to be in the forefront of science and engineering as technology advances. This project is innovative and creative in that it has not been appeared in any part of the school curriculum. The project promotes excellence by giving students expanded hands on opportunities in STEAM, promoting a new set of questioning behaviors, developing an understanding of up-to-date technology content, and infusing engineering practices into everyday life.

OBJECTIVES/PURPOSE:

- To develop enhanced understanding of electricity circuits
- To design and test circuitry using conductive pens/markers, foil, wires
- To explore the pros/cons of renewable solar energy and the need for it
- To construct a solar vehicle and conduct solar race
- To identify and modify variables recording effects on solar vehicle
- To use measuring device to record effects variables on solar energy output

- To experiment with energy transfer and explore sun powered transport as it relates to space exploration

FINAL RESULTS

The solar energy introduction using the Lego Mindstorm kit was a complete success. 40 students in the district were introduced to the concept of solar energy. It is difficult to assess the attitudinal change or impact, but there was a lot of enthusiasm among the students as they learned about, explored with, and discussed solar energy. We do not do formal assessments in our program, but from an anecdotal perspective the students were able to grasp the concept and apply it.

All in all, the project was a great success. Exposing the students to renewable energy in its various forms is a win-win situation. You never know what will spark an idea or career or when that will happen.

Sustainability: Aerospace Adventures took place on school premises, it is an afterschool program. The program can easily be repeated annually over years and expanded with small investment in follow-up supplies and consumables. Each spring, Aerospace Adventurers runs a Ledyard Family Aerospace Festival for the Ledyard school community. A solar power activity station will be incorporated into this event. This program/kit has no consumables and is completely sustainable. The school PTO's will provide accessory items needed to run the project such as lamps and batteries. Plan to introduce the kit and concept for next year's Aerospace Adventurers.

EVALUATION

In order to assess progress, a pre-assessment of student knowledge and understanding about electricity/solar power will be created. Teachers will examine science journals. A content assessment will be created and presented to students in a game format. The test was in the form of a race competition. Those cars that set up their solar panels correctly had the fastest cars.

PROGRAM ADMINISTRATION

The 2 Aerospace Adventures instructors read, synthesized and taught the lessons with the ample instructions provided with Lego kit. LEAF will publicize grant results on their website. <http://ledyardeducation.org/>. These programs can be offered free to teachers in the district. We did not do any community/social media sharing. Photos of the competition were taken and used for school purposes. Other teachers in this district can use this kit free of charge.

LESSON PLANS

Day 1: Introduction to Solar Energy

- Students were introduced to the concept of solar energy, what it is, how it works, and its application in the real world.
- Watched videos on the subject and answered student questions as the lesson progressed.
- Completed circuits and drew them for:
 - LED, battery and a piece of wire
 - Light diode with battery and foil as conductor
 - Light diode with a drawn circuit using battery and conductive pens and markers
- Repeat above activities using photovoltaic cell instead of battery.
- Students maintained a science journal for duration of this project.
- Small solar panels were handed out along with small output devices (light bulbs, motors) to see solar power in action.

Day 2: Construct Lego Solar Panel Kit

- Students followed Lego guide to build and test various aspects of solar energy.
- Tested ideas were:
 - Different light sources
 - Various angles of incidence
 - Different distances from source to panel
- Use metering device to record effects of variables (e.g. light source distance, angle) on electrical output.
- Students plotted results in graph form and discussed results with whole class.

Day 3: Solar Race Car Competition

- Review Day 2 concepts and results and complete what was not finished on previous days.
- Built solar race cars from the kit.
- Using what was learned from days one and two, completed the construction and tested the builds.
- The test was in the form of a race competition. Those cars that set up their panels correctly had the fastest cars.

Links for additional information:

LessonPlans: <http://www.heritage.isd197.org/common/pages/DisplayFile.aspx?itemId=1828430>
[3](#) Lego Teacher's Guide

<https://www.youtube.com/watch?v=qgnCbROfNYM>

<http://www.siliconsolar.com/solar-cart-kit-for-classroom-diy-education.html>

http://www.amazon.com/gp/offer-listing/B004FEXUP4/ref=olp_fsf?ie=UTF8&condition=new