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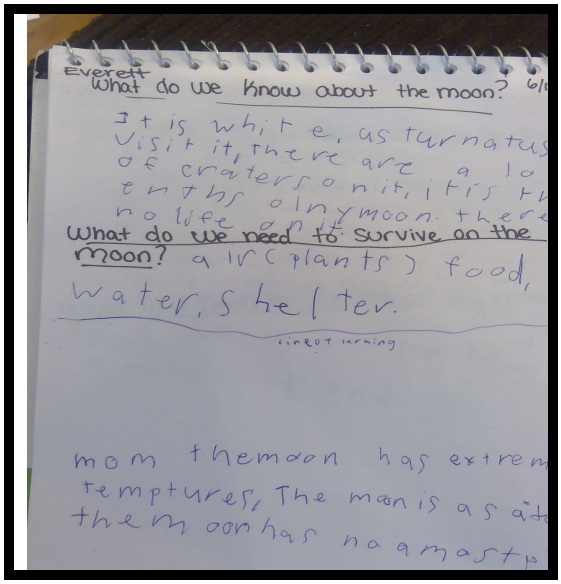
Engineering Design Challenge

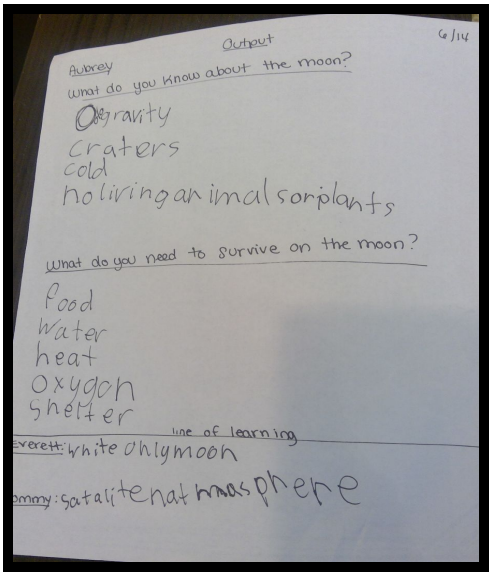
For this project, I have designed a Project Based Learning Unit entitled 'Colonizing the Moon'. The purpose of the unit was to knit together four engineering design challenges, all with the aim of answering one driving question: ***How can we, as the first lunar colonists and structural engineers, meet our basic needs for survival on the moon?*** Students participating in this project participated in three of the four engineering challenges. Please see the attached project design PBL Template, which identifies standards, objectives and activities associated with this project.

Implementation

For the purposes of this assignment, I will focus on the implementation of our first engineering design challenge, though the students (my children) participated in 3 of the four engineering challenges. You will see elements of the overall PBL in the Engage and Explore portion of this lesson. You will also see an integration of the 5E Model with the Engineering Design Process in the headings of this lesson, as I think both are extremely important for the implementation of a successful engineering and Project Based Learning lesson.

Engage: Students were given five minutes to answer the following in the output side of their science notebook: 1. What do you know about the moon? And 2. What do you need to survive on the moon? After five minutes, students exchanged ideas, and added the other student's idea under the 'line of learning' in their notebooks:

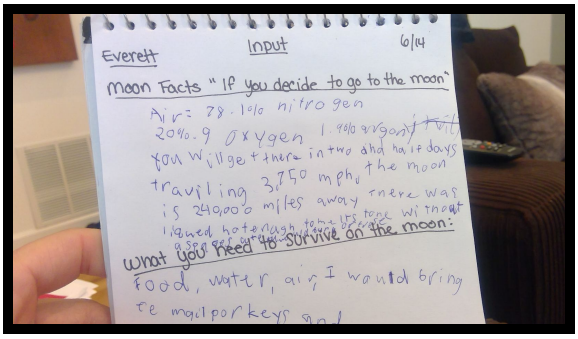




Explore/Identify the Problem: After recording prior knowledge and initial thoughts about the moon/survival on the moon, students watched the NASA video, Living on the Moon, and were introduced

to the PBL's Driving Question: *How can we, as the first lunar colonists and structural engineers, meet our basic needs for survival on the moon?*

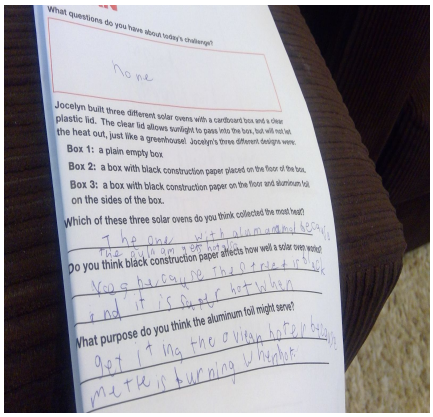
Explain: Students listened to the book *If You Decide to go to the Moon* by Faith McNulty read aloud. They took notes on the Input side of their science notebooks on the moon:

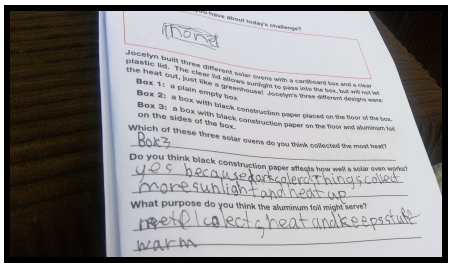


Students read *Can we cook while on the Moon?* To initiate their understanding of today's design challenge.

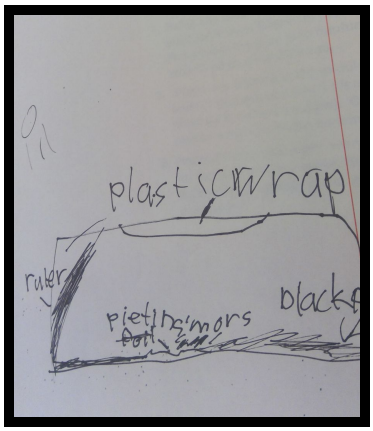
Students were introduced to the engineering design challenge of the day: *Your mission is to design and build a solar oven to cook your own S'mores with the materials provided.*

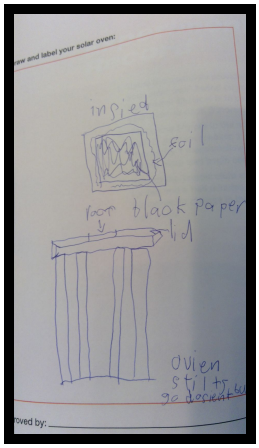
Brainstorming: Students answered questions about previously created solar ovens to prepare them to create their own designs:



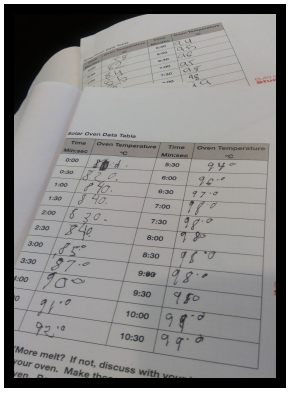


Design/Build: Students created individual designs and explained their designs to one another. They built first solar oven prototypes independently and tested them:



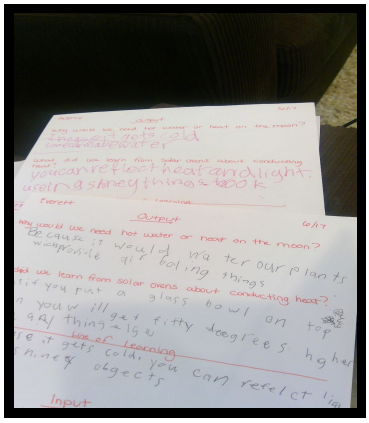


Test/Evaluate: Students tested and recorded data from their solar oven initial investigations. Major differences between the two designs: Everett chose wax paper as a covering for his S'more to retain the heat. Aubrey covered her S'more in plastic wrap to retain heat. Both students got temperature increases to 99 degrees, up from 78-80 degrees:



Elaborate/Redesign: Students discussed what they thought made their designs successful. They brainstormed ideas of what might improve the heat in their project, and then created a collaborative solar oven using a glass dome rather than plastic or wax covering to retain the heat. They also added more foil to improve the reflection in the oven:

Share the Solution/Reflection: Students were able to increase the temperature in their oven to 155 degrees. They incorporated the solution and reflection into the output portion of their science notebooks.



Instructor Reflection: The engineering design challenge presented some unique 'challenges' for me as an instructor, as I had my own two children, who decided it would be a great time to fight instead of collaborate on the first day of design. It was easier to get them to create independent projects rather than work together.

On the second day of the challenge, the students did much better collaborating. They were excited about working toward a common goal of increasing the temperature inside their solar ovens to 200 degrees. They came up with the idea of using a glass dome to increase the heat in their oven. Completing this project at home they were able to use a modified material to improve the heat in their oven.

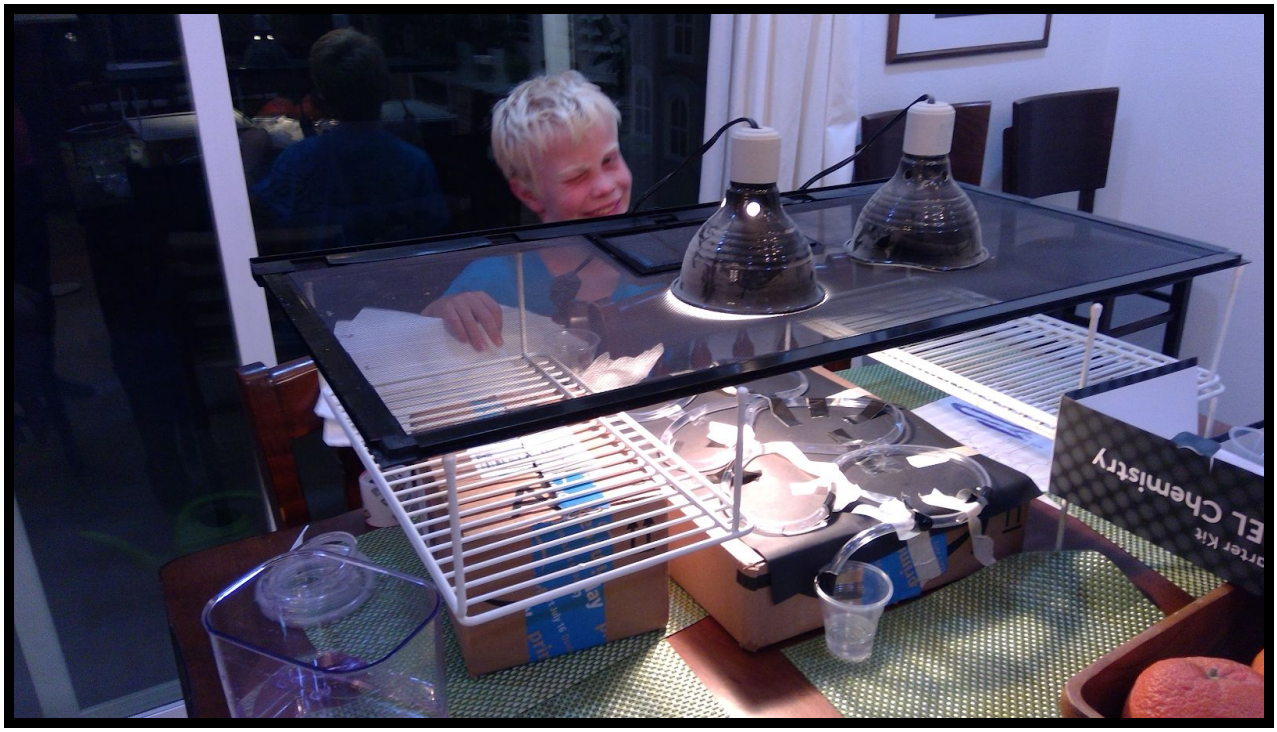
*Please see the attached PBL Design worksheet for standards covered.

The Engineering Design Process helped my children read a thermometer, understand concepts of absorption of heat, as well as the importance of reflection of light when utilizing the sun's energy. I could make this more scientific by incorporating vocabulary words pertaining to heat retention/refraction.

WIth future students, I will use plastic domes to increase the heat in their ovens. A greater focus of mine will be to simplify the solar water heater lesson (pictured below), and the Ozobot lesson for the third grade students at my school. I also have to further develop the Lunar Plant Chamber lesson.

My children reaching their ‘expiration date’ during their solar water heater builds:

My son’s water heater raised the temperature 7 degrees!



After two unsuccessful trials with the Ozobot supply pick-up, my daughter used a modified maze to help her Ozobot successfully pick up supplies:

Works Cited

McNulty, Faith: If You Decide to go to The Moon. New York: Scholastic, 2005.

NASA On The Moon Educator Guide:
https://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/On_the_Moon_Guide.html