

Design Notebook

A NASA/Design  
Squad Challenge  
“Roving on the  
Moon”

The “E” in  
Engineering SCED  
542

Featuring 7<sup>th</sup> and 8<sup>th</sup>  
grade students

AMY RAMSDELL

10/31/18

# ENGINEERING DESIGN CHALLENGE

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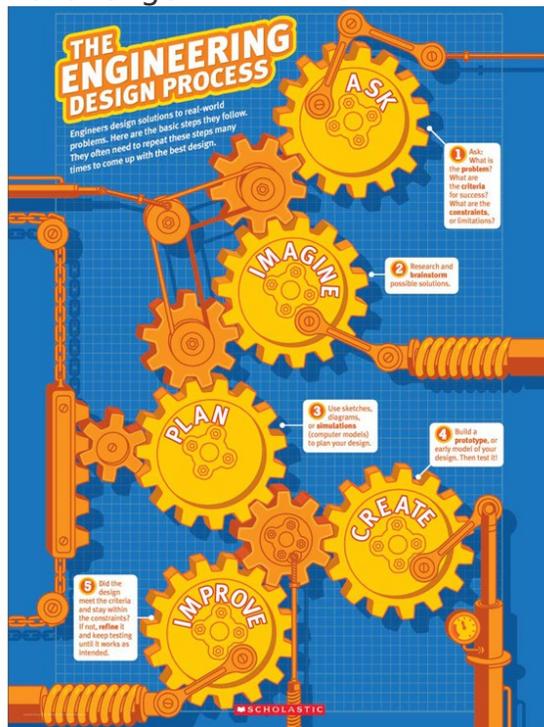
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### **1. The Engineering Design Process:**

A modified version of the engineering design model put forth by NASA was chosen for the implementation of this challenge in the middle school classroom.

ASK, IMAGINE, PLAN, CREATE, EXPERIMENT, & IMPROVE.

Posted on the wall in the classroom is this Scholastic poster representing the engineering design process. This is an easy to follow design that mirrors that of NASA's design plan. Students referred to this poster during the 'Roving on the Moon' design challenge.



## 2. Implementation timeline:

Week 1:

Prior to the 'Roving on the Moon' challenge, students were challenged to design a habitat on Mars.

Days 1 & 2:

Students read about Mars and sketched out their design for a colony on Mars. "At Home on Mars" from *Science World* (a Scholastic magazine) from March 7, 2011: Vol. 67 No. 10 was chosen.



Day 3:

On the third day, students watched two short videos on challenges faced with living on Mars.

The first video was by SciShow Space titled "The Hardest Things About Living on Mars" <https://youtu.be/S3lwjwkb2Ww>

The second video was by TEDed titled "Could We Actually Live on Mars?"

<https://youtu.be/DMMPYkRrd4o>



What is the challenge? Designing and building a rubber band-powered rover that can scramble across the surface, be it a table, the floor, pavement, or grass and dirt.

Imagine

Brainstorm about the problem. What ideas are there to make this work? How can a rubber band create the energy to move the rover?

Plan

Sketch out ideas for the rover.

Create

Build the original rover as a prototype.

Improve

What can be done to improve the performance of the rover? Sketch out the ideas and build them. Test the idea.

**4. Engineering Design Notebook**

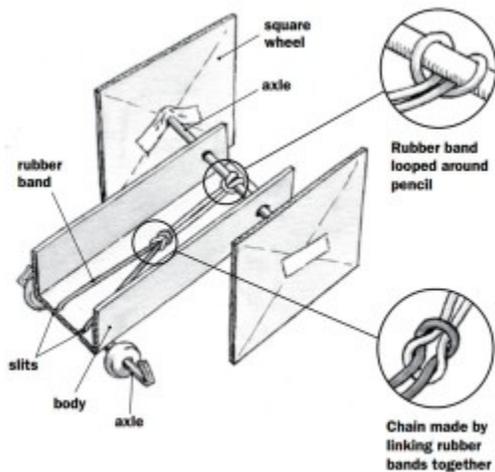
a. Identify the problem: Designing and building a rubber band-powered rover that can scramble across the surface, be it a table, the floor, pavement, or grass and dirt.

b. Brainstorming: Students spent time examining the information provided on the “Roving on the Moon” challenge sheet. They had questions about the square wheels as well as asking how rubber bands could provide energy to move the rover. The students did not think the square wheels would work at all, but they followed the provided build instructions.

c. Design: Students had to sketch their plans for carrying out the NASA design.

d. Build: After the design process, students gathered their materials and built the first prototype of the rover.

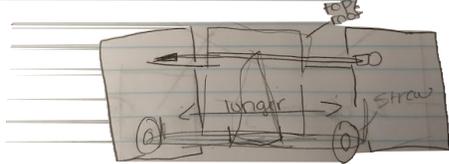
e. Test & Evaluate: Students were *amazed* that the square when design moved. None of the teams had a rover that moved more than a few rotations of the large, square wheels but they were very excited none-the-less.



Roving on the Moon Challenge

10/3/18 You can't keep one axle from moving so because of the other one won't move

10/4/18 We wined up the axle and let it spin. We figured out that the tension in the band allowed it to spin faster. We will use the same process, except we will make the car bigger and conceal the inside tomorrow.



(the winning



Redesign: Students jumped on this stage, full of ideas to improve their rovers. Most students immediately rounded their wheels. Some added an extra pair of candy wheels on the back axel. One group team) added

additional rubber bands to increase power. Another group added spikes on the wheels to increase traction.



g. Share the solution: After pitting the rovers against each other determine the winner, students examined and compared all the rovers. They determined that round wheels were the better than square but the best modification on the original design was to add more rubber bands to increase power leading to further distance travelled.



## 5. Reflection:

- a. What went well with the engineering design challenge? This design challenge fit very well the middle school setting. I liked how it provided students with a challenge that gave them a solid starting point by providing a starting design; a prototype, and yet it was *not* a cookie-cutter lab that detailed every step of the way. The students had to figure out how to make the rubber band-power work on their own.
- b. What did not go well with the engineering design challenge? I have no complaints with this activity at all. Everything went smoothly although the students cutting out their own pieces made me a little nervous. They did this with no problems (and while wearing goggles!).
- c. What concepts were covered? Students were reminded to reflect on prior knowledge of metric units of measurement and lab safety. For the seventh-grade students, Newton's 2<sup>nd</sup> law (force = mass x acceleration) was new but the eighth-grade students were already familiar with the concept. Students were exposed to new technology standards, # 7, 8, and 11 covering the influence of technology on history, attributes of design, as well as the application of design.
- d. How did the engineering design process help teach the science and mathematics process? I noticed that while the students were following the engineering design process to solve the problem of building the best rover *they did not seem to notice they were doing math or science* at least as they usually see them in the classroom. The students demonstrated skills that they had previously learned and powered through the unknown by collaborating and asking appropriate questions.
- e. Was the engineering design process appropriate? Does it need to be simplified or more complex? The design process I chose for the students was appropriate. As beginning 'engineers', five steps was perfect.
- f. What improvements can be made to this activity for future students? I will do this activity again with other students and will leave it as is. I do believe that starting with the Mars habitat challenge, videos, and article piqued their interest and got them in the frame of mind to design an actual Moon rover.