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Engineering Design Challenge-Major Project
Phase 1 - Research and Planning
Due June 12, 2019

Launch It -

http://www-tc.pbskids.org/designsquad/pdf/parentseducators/nasa_ds_guide_508_03launch_it_cs.pdf

Big Idea(s)

Engineering Design Process

Potential Energy/Kinetic Energy

Thrust

At this time I chose a variety of grade level standards not knowing what was introduced to students before they came to 5th grade and also if I would use this challenge with my new job in 6th grade science.

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem

MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object

MS- Plan an investigation to provide evidence that the change in an

PS2-2. object's motion depends on the sum of the forces on the object and the mass of the object.

3-PS2-
1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object

5-PS2-
1. Support an argument that the gravitational force exerted by Earth on objects is directed down.

The Launch It Challenge is a moderately structured to an ill structured problem. As noted in *Principles for Teaching Problem Solving* a moderately structured problem requires varying strategies and adaptations and ill structured has vague and unclear goals. There is more than one acceptable solution strategy. It provides opportunities for many right answers. Students are going to need to have some declarative knowledge and experience with Newton's Laws to be able to power the rocket with air. The knowledge and understanding will be evident in the student explanation and the communication of the solution.

Students will need:

- to understand forces – Newton's Laws appropriate to their grade level and understanding, unbalanced forces
- to understand and demonstrate potential and kinetic energy in relationship to the balloon launcher.
- General knowledge of rockets and parts of a rocket
- to use the chosen engineering design process
- to take notes in their engineering design notebook

Many of the concepts/content may need to be introduced before the challenge is given. There will need to be investigations using Newton's Third Law, videos and exploration of potential and kinetic energy. Students may explore NASA site for rocket information. Students will be using and learning about the engineering design process chosen for the class.

I have chosen to have my students participate in the Launch It challenge from the NASA/PBS Design Squad site. I have adapted the lesson so for my students at this time.

I am doing things a little out of order because I have been on medical leave and have just returned to school in the past two weeks. I have my students for only three more days and those days are field day, field trip and $\frac{1}{2}$ of school day (last day). I had them participate in the main challenge and will report on their work in the next phase. I have chosen the design process and created an engineering notebook that students used for their challenge.