Katie Offerman

Major Project Engineering Design Notebook

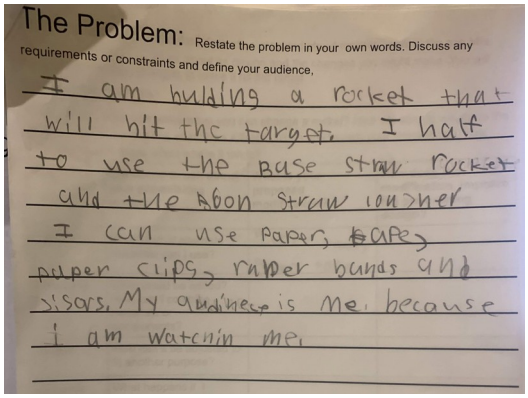
Adams State University

Identifying The Problem:

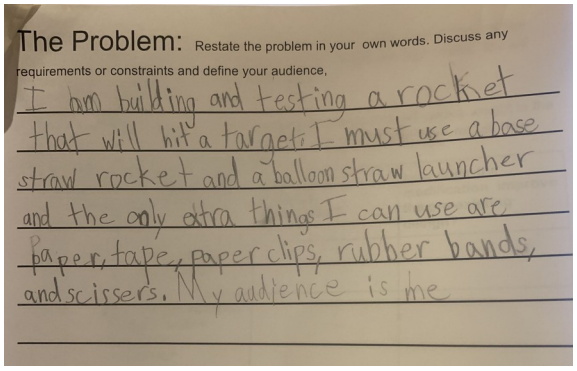
Students started out reading an informational sheet about the problem, which stated...

> Going to the moon? You'll need a rocket. The rockets NASA sends to the moon go up to 18,000 miles (29,000 km) per hour. But it still takes about three days to get there. So, sit back, relax, and enjoy the view. We challenge you to design and build an air-powered rocket that can hit a distant target" (Dunbar, B. (2010, January 26))

They read about the history of rockets and then restated the problem in their own words, defined the constraints, and created a basic rocket and launcher to test.


The Problem: Restate the problem in your own words. Discuss any requirements or constraints and define your audience,

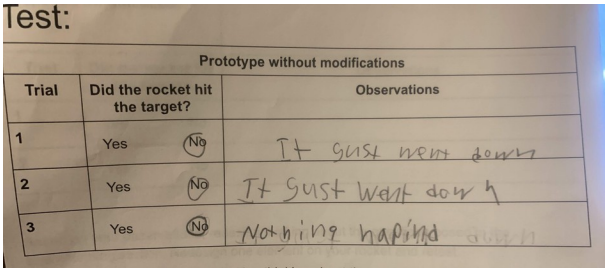
I am hulding a rocket that will hit the target. I halt to use the base straw rocket and the Abon straw lonsher I can use paper, tape, paper clips, ruber bands and sisors. My audiece is me. because i am watchin me.


The Problem: Restate the problem in your own words. Discuss any requirements or constraints and define your audience,

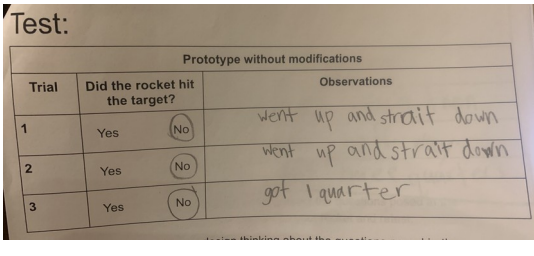
I am building and testing a rocket that will hit a target. I must use a base straw rocket and a balloon straw launcher and the only extra things I can use are paper, tape, paper clips, rubber bands, and scissers. My audience is me

Brainstorming

Students first created and tested the basic rocket design to see what happened.


Test:

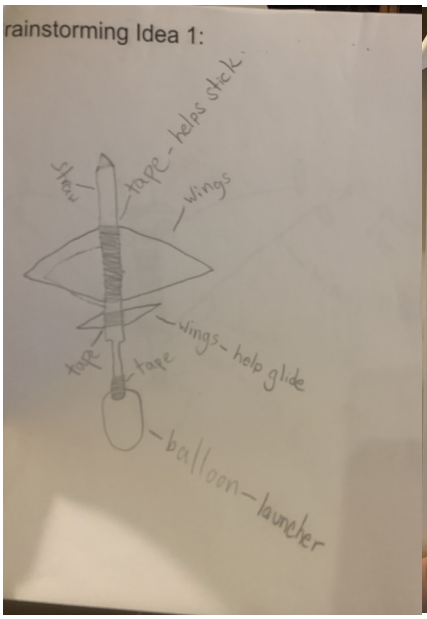
Prototype without modifications		
Trial	Did the rocket hit the target?	Observations
1	Yes (No)	It gust went down
2	Yes (No)	It gust went down
3	Yes (No)	Nothing hapind

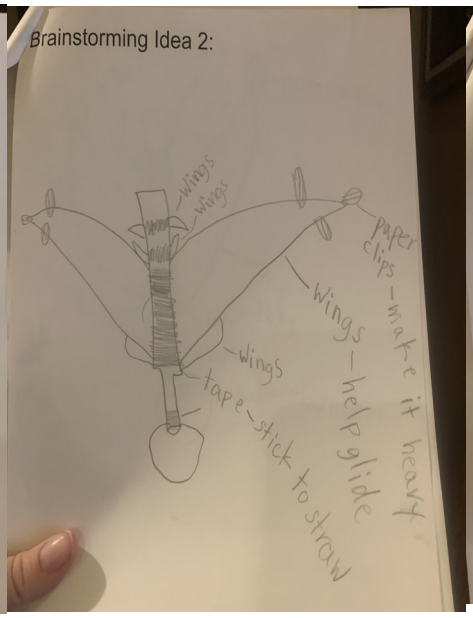

Test:

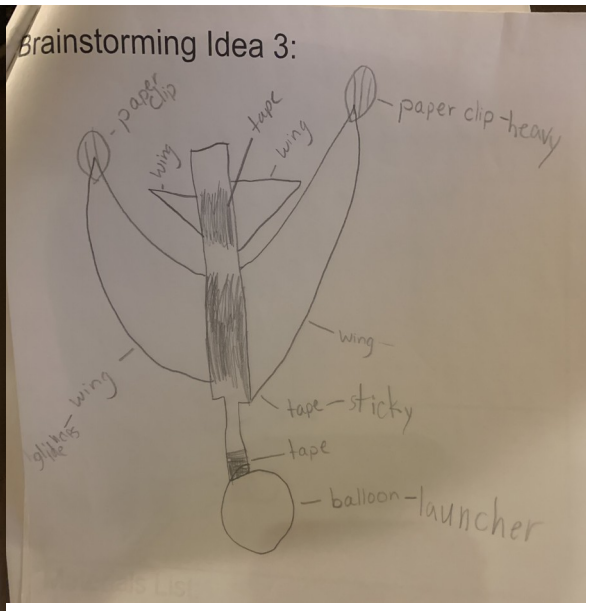
Prototype without modifications		
Trial	Did the rocket hit the target?	Observations
1	Yes (No)	went up and strait down
2	Yes (No)	went up and strait down
3	Yes (No)	got 1 quarter


Trash

After testing the basic rocket, students brainstormed three designs they though would improve the chances of the rocket hitting the designated target.

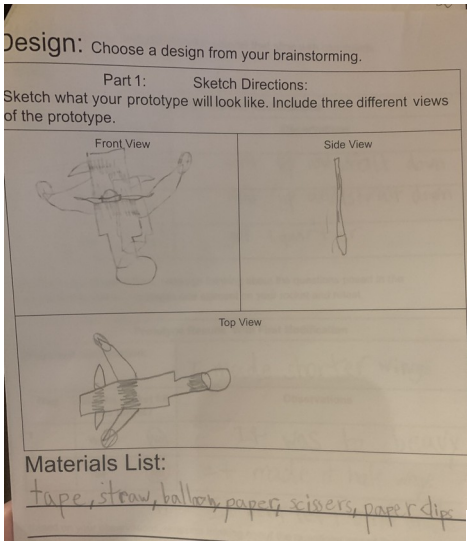


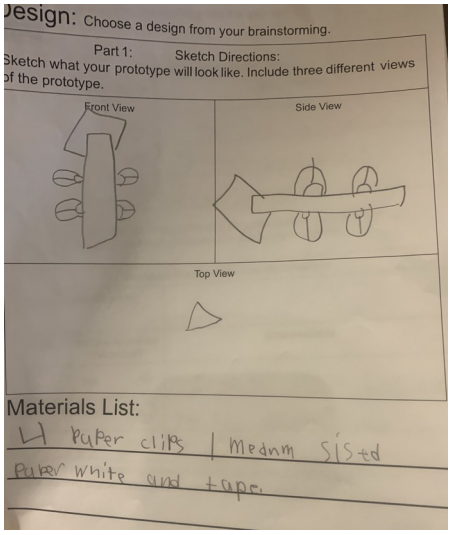




Design

Students decided on one design and drew it from the top, bottom, and sides and made a materials list.



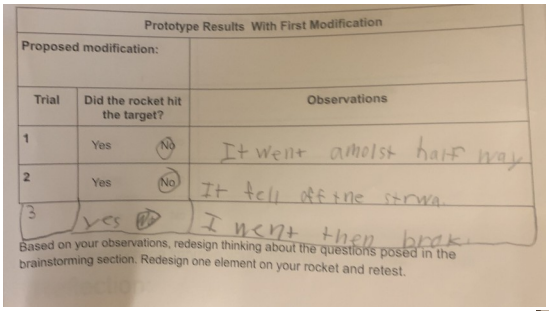


Build

After deciding on a design, students began to build their rockets.

Test and Evaluate

Students tested their design three times and wrote observations about how the rocket acted and if it hit the target.

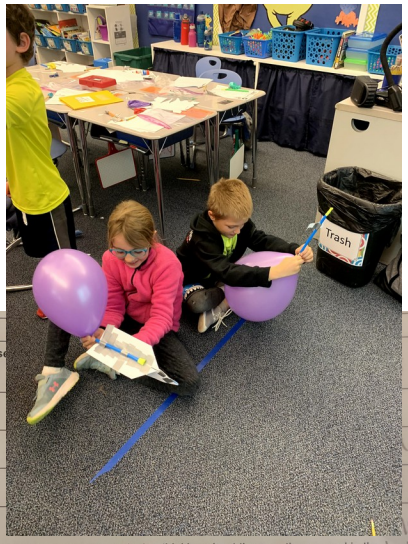


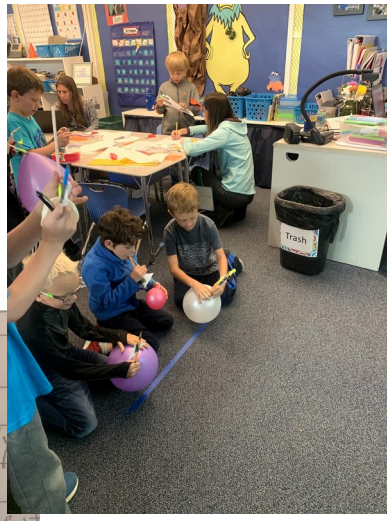
Prototype Results With First Modification

Proposed modification:

Trial	Did the rocket hit the target?	Observations
1	Yes (No)	It went amolst half way
2	Yes (No)	It fell after strwa
3	Yes (No)	I went then brak

Based on your observations, redesign thinking about the questions posed in the brainstorming section. Redesign one element on your rocket and retest.





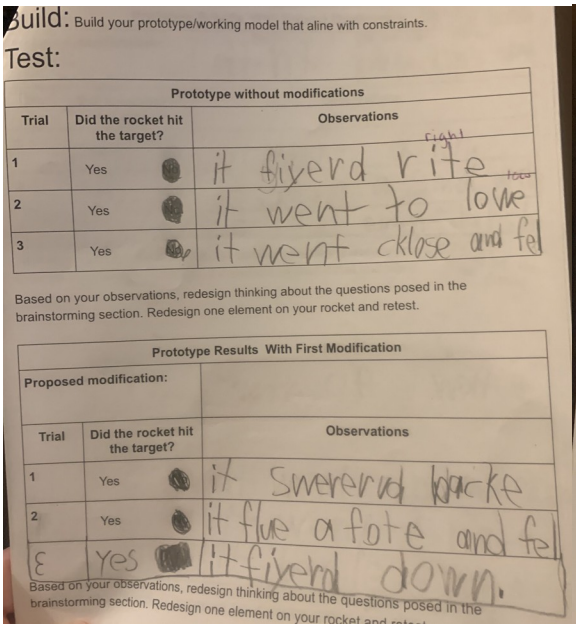
Propose

Trial
1
2

Based on your observations, redesign thinking about the questions posed in the brainstorming section. Redesign one element on your rocket and retest.

Redesign

Students then redesigned and tested two more times using their observations to determine one change to their prototype.



Build: Build your prototype/working model that aline with constraints.

Test:

Prototype without modifications

Trial	Did the rocket hit the target?	Observations
1	Yes	it fiyerd rite (right) too
2	Yes	it went to love
3	Yes	it went cklose and fel

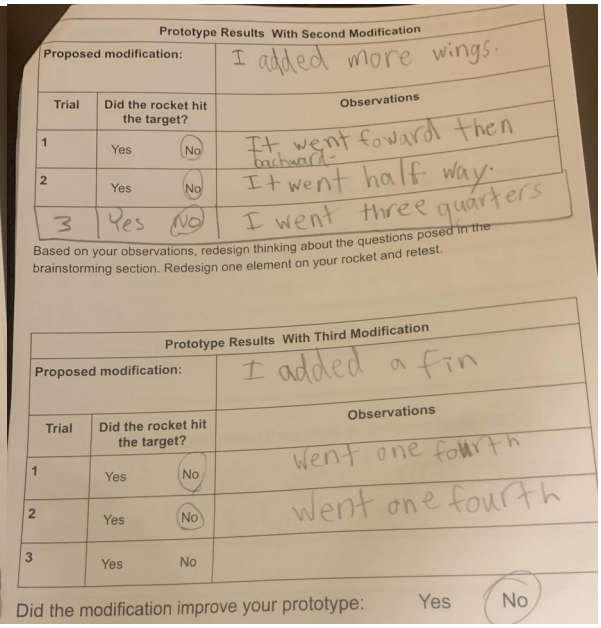
Based on your observations, redesign thinking about the questions posed in the brainstorming section. Redesign one element on your rocket and retest.

Prototype Results With First Modification

Proposed modification:

Trial	Did the rocket hit the target?	Observations
1	Yes	it Swererd backe
2	Yes	it flue a fote and fel
3	Yes	it fiyerd down.

Based on your observations, redesign thinking about the questions posed in the brainstorming section. Redesign one element on your rocket and retest.



Prototype Results With Second Modification

Proposed modification: I added more wings.

Trial	Did the rocket hit the target?	Observations
1	Yes (No)	It went foward then (backward)
2	Yes (No)	It went half way.
3	Yes (No)	I went three quarters

Based on your observations, redesign thinking about the questions posed in the brainstorming section. Redesign one element on your rocket and retest.

Prototype Results With Third Modification

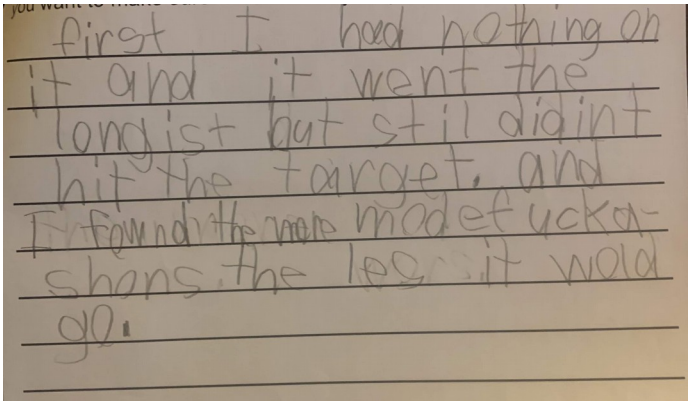
Proposed modification: I added a fin

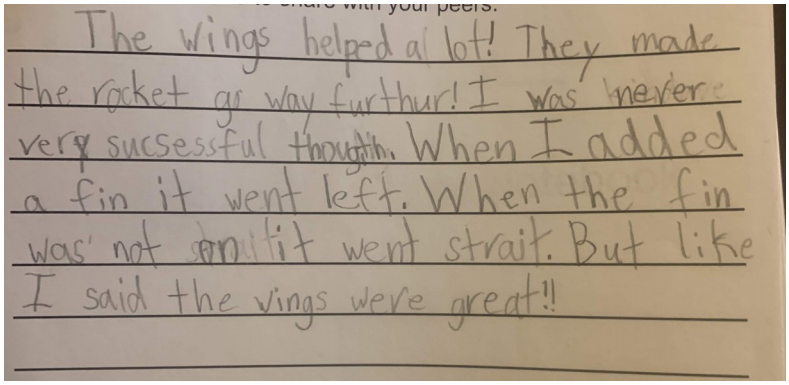
Trial	Did the rocket hit the target?	Observations
1	Yes (No)	went one fourth
2	Yes (No)	went one fourth
3	Yes No	

Did the modification improve your prototype: Yes (No)

Share the Solution

In order to share their solutions, students wrote the design feature they felt was the most successful and why. They had verbal discussions about how weight affects force and motion, and many decided that they need a better launcher that creates more force in order to utilize their designs effectively.





Reflection

Overall, the engineering design challenge went well. Students were able to verbally discuss the affects of force and motion on their rockets and attempted to make design changes that would help the rocket reach its target. Students did a great job of defining the force that caused the rockets to launch as well as what worked against the force.

I found it difficult to manage all of the children in each step and make sure they were following the design process step by step. I spent a lot of time making new launchers because the balloons we used stretched and would not launch the rockets. The students found the design notebook to be a bit difficult. I made the mistake of only having two places to record data instead of three and the students had to fill in the third.

The Colorado State Standards covered by this lesson are:

Science:

1. Standard 1 Physical Science Grade 2: Changes in speed or direction of motion are caused by forces such as pushes and pulls.

Mathematics:

1. Standard 3 Mathematics Grade 3: Visual displays are used to describe data
2. Standard 3 Mathematics Grade 3: Linear and area measurement are fundamentally different and require different units of measure

NGSS Standards covered by this lesson are:

Science

1. K-PS2-1-Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.

2. K-PS2-2 Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.

The engineering and design process helped my student with the science and mathematical concepts because they had to follow the process, think through the steps, and apply knowledge of force and motion to make changes to their design. It made it easier to associate the learning with the engineering process and relate it to what real life engineers and scientists do. It was also wonderful for them to see that data and observations should influence their design changes rather than just making changes and seeing what happens.

I believe I did choose an appropriate engineering design process. I think I would only do two trials instead of three because it caused us to take a lot more time than I had originally planned. I would also like to include a way for the students to share their findings with someone other than myself or their classmates.

I have already made changes to my design notebook based on the issues I saw with my students. I would break the steps down into days and keep everyone on the same steps so I can monitor their progress better. I know I need higher quality balloons to build the launchers out of. I could extend the challenge by having the students redesign the launchers.

Appendix:

Mrs. Offerman's Design Notebook

Launch It Lesson

Resources:

Dunbar, B. (2010, January 26). Launch It. Retrieved from https://www.nasa.gov/stem-ed-resources/otm-launch-it.html

Mathematics Academic Standards. (n.d.). Retrieved from http://www.cde.state.co.us/comath/statestandards

Next Generation Science Standards. (2019, September 9). Retrieved from https://www.nextgenscience.org/

Science Academic Standards. (n.d.). Retrieved from http://www.cde.state.co.us/coscience/statestandards