

Creating a Moon Lander

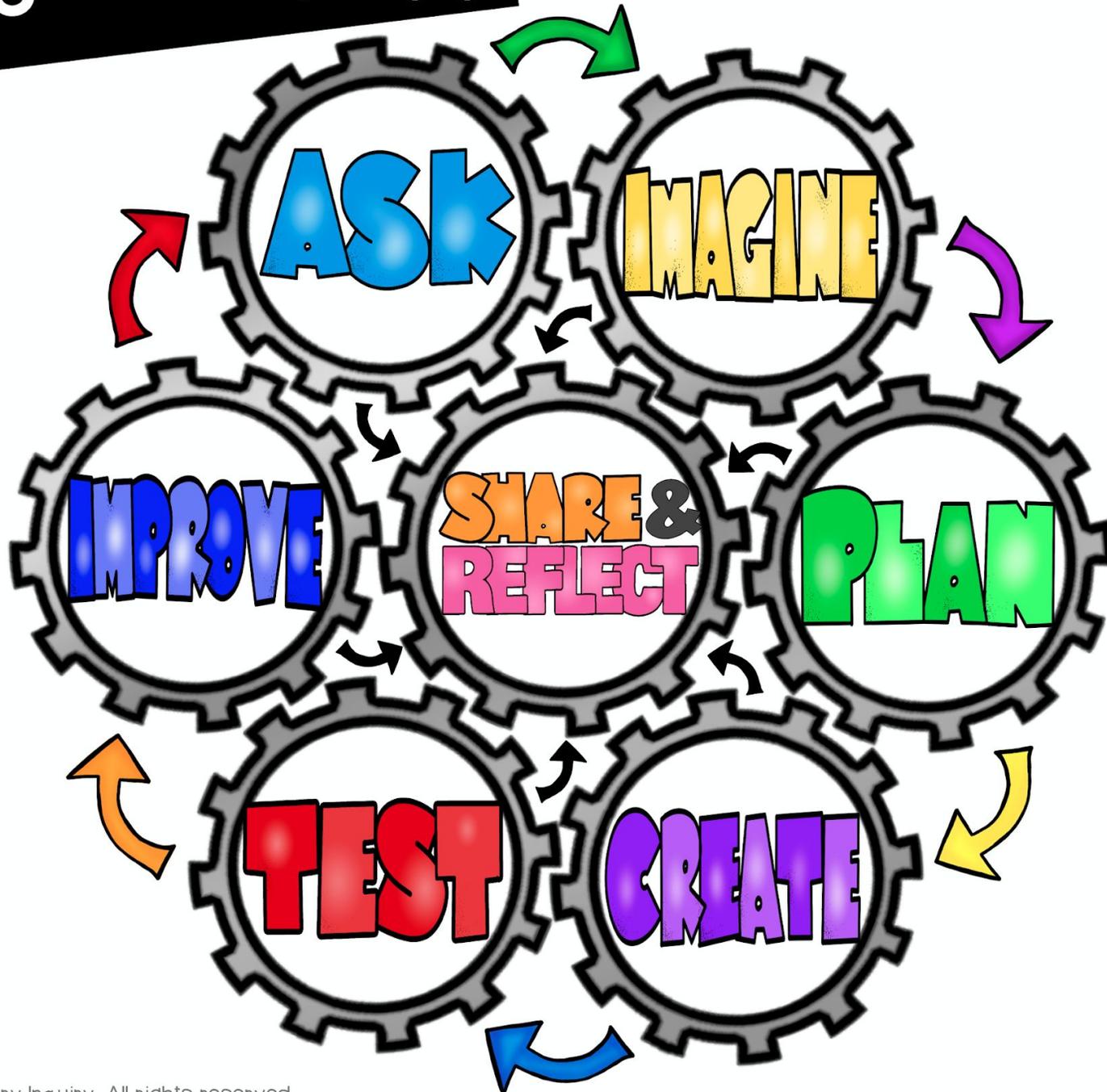
Team Members:

- Lane's Third Grade
- Mazzarela's Third Grade
- Kirsch's Third Grade
- Young's Third Grade
- Bloom's Third Grade
- Kukla's Third Grade



The Engineering & Design Process

Creating a Moon Lander



Ask

The Challenge:

Have you ever wondered how astronauts land on the moon? Landing on the moon is tricky. First, since a spacecraft can go as fast as 18,000 miles per hour on its way to the moon, it needs to slow way down. Then it needs to land gently to keep the astronauts inside protected.

NASA is looking for safe landing sites on the moon and people to design and build a spacecraft that can land there without injuring the spacecraft or astronauts. You will be challenged to design and build a shock-absorbing lander that protects two astronauts when landing on the floor from the ceiling of our room.

Criteria for Success:

- The lander can land right side up without flipping or tilting.
- The astronauts remain inside their cabin throughout the landing.
- The lander is built using only the materials provided.
- Must be finished by: End of the third class period.

ASK: vocab

Important vocabulary words to know & use:

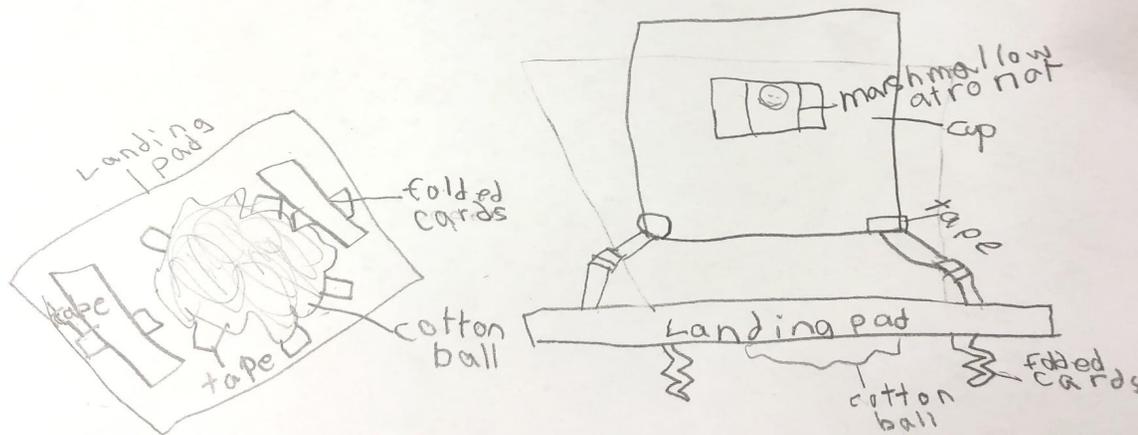
Term	Definition
Shock-absorbing	Absorbs the energy of an impact
Gravity	A force that exists on objects in space
Air resistance	Air exerts a force on an object as it falls, slowing it down
Acceleration	Speeds up

Imagine

Idea #1

Possible Strengths

- ❖ The index cards are folded like a spring to absorb the shock.
- ❖ The cotton balls were taped under the cardboard in order to create a soft landing and aid the index cards in absorbing the shock..

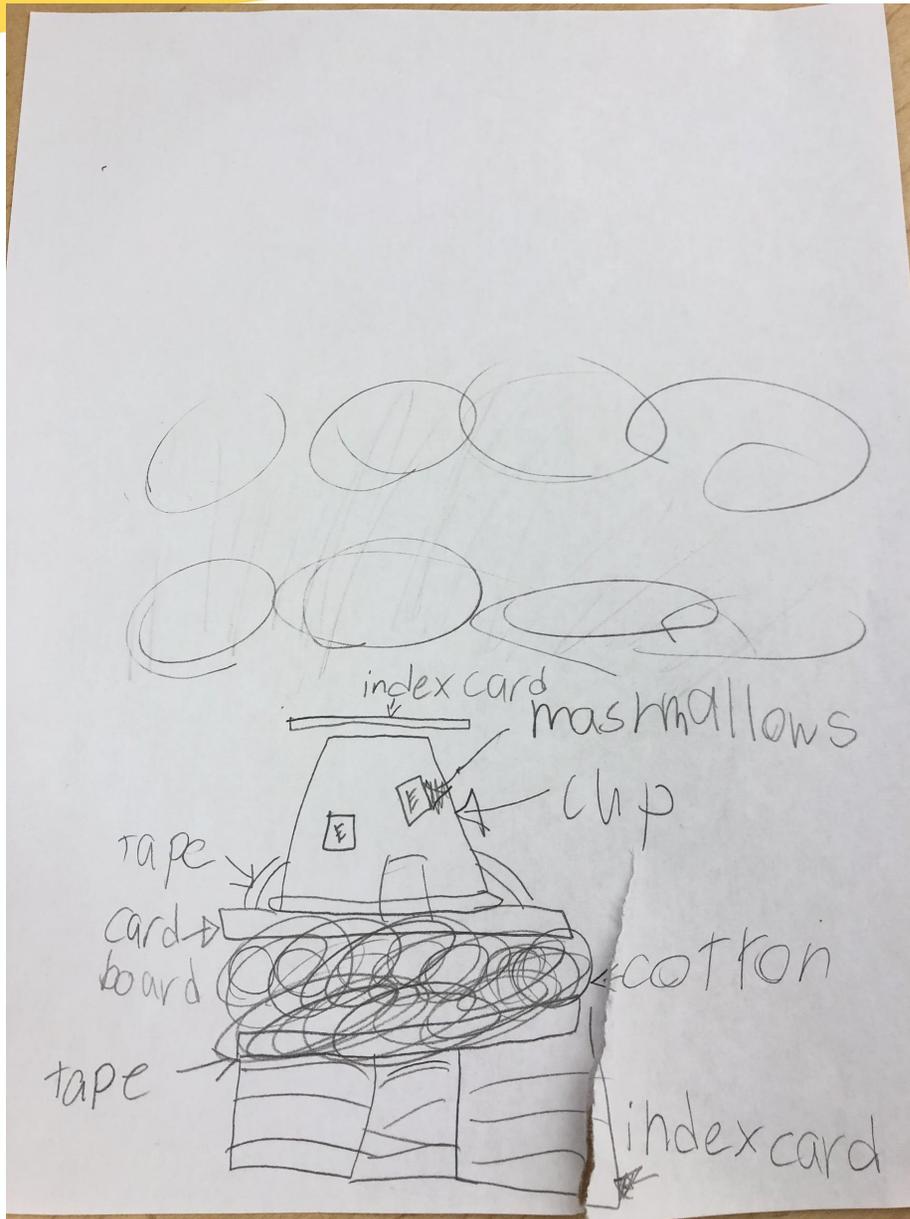


Possible Weaknesses

- ❖ "Will the cup bend and fall off the cardboard because the straws will bend?"
- ❖ "We are not allowed to have a lid so the marshmallows have no way of staying inside."

Imagine

Idea #2



Possible Strengths

- ❖ “We used all of our cotton balls and taped them under the cardboard so it can bounce and land gently.”
- ❖ The index cards were folded to act as springs.
- ❖ The cup was taped to the cardboard securely so it would not fall off.

Possible Weaknesses

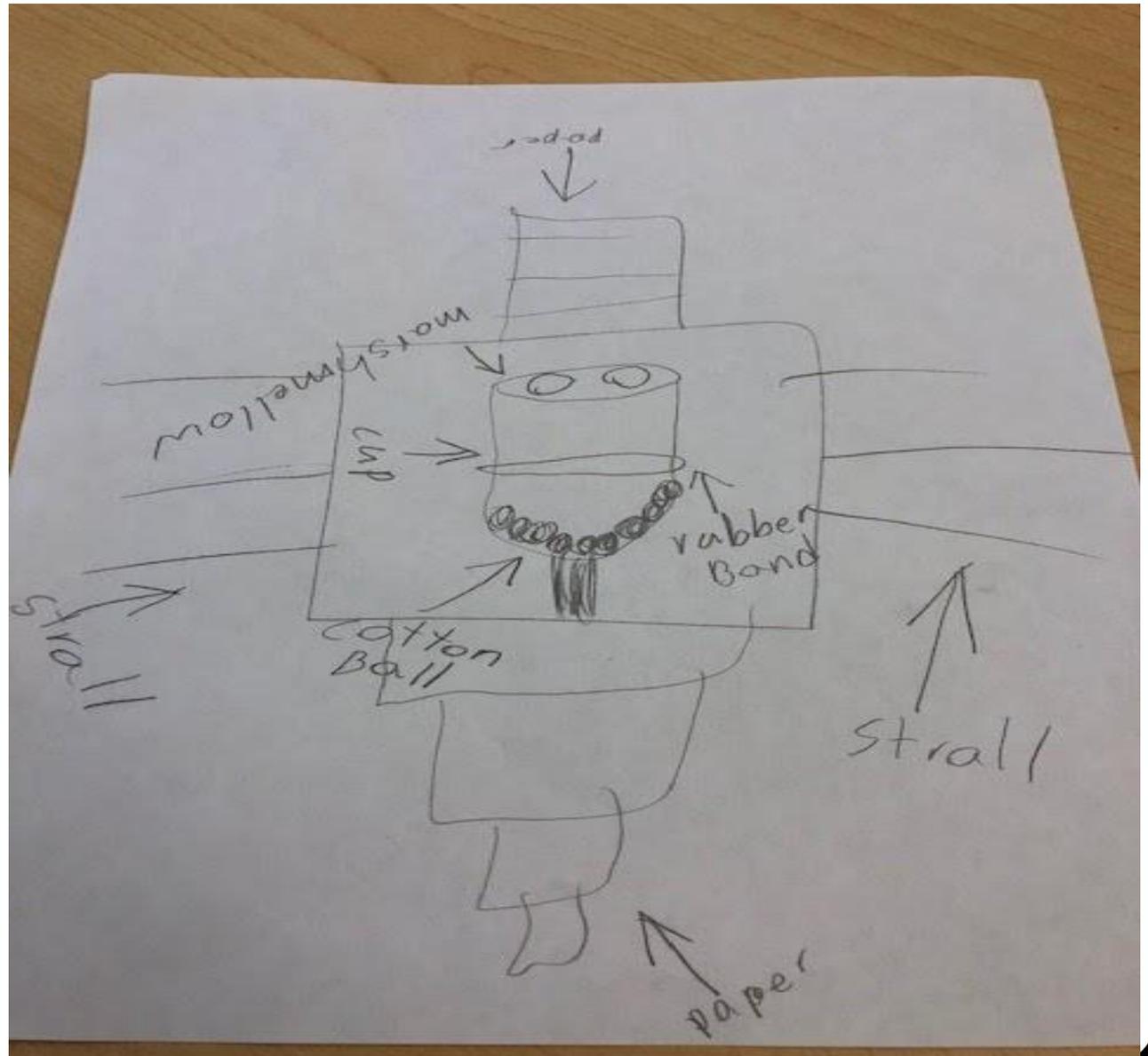
- ❖ After I told them they had to throw away their lid, “We can’t use a lid, how are the astronauts going to stay in there?!”
- ❖ They did not use their straws or rubber bands and relied on their shock absorbing materials and tape.

Plan

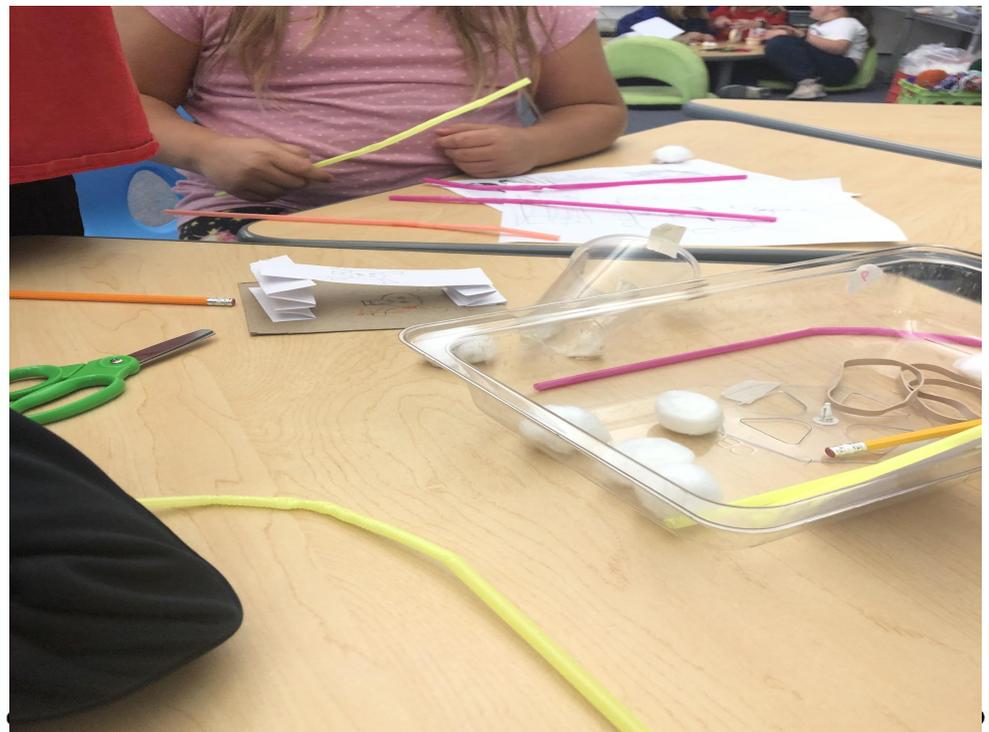
Students used their sketches from the previous step in order to receive the materials to start building their landers.

Materials & Tools:

- Plastic cup
- 8 straws
- 10 cotton balls
- 3 index cards
- 5in x 5in piece of thin cardboard
- 2 large marshmallows (use when testing)
- 3 rubber bands
- Tape



Create



Create



Test

Criteria for Success:

- The lander can land right side up without flipping or tilting.
- The astronauts remain inside their cabin throughout the landing.
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- Must be finished by: End of the third class period.

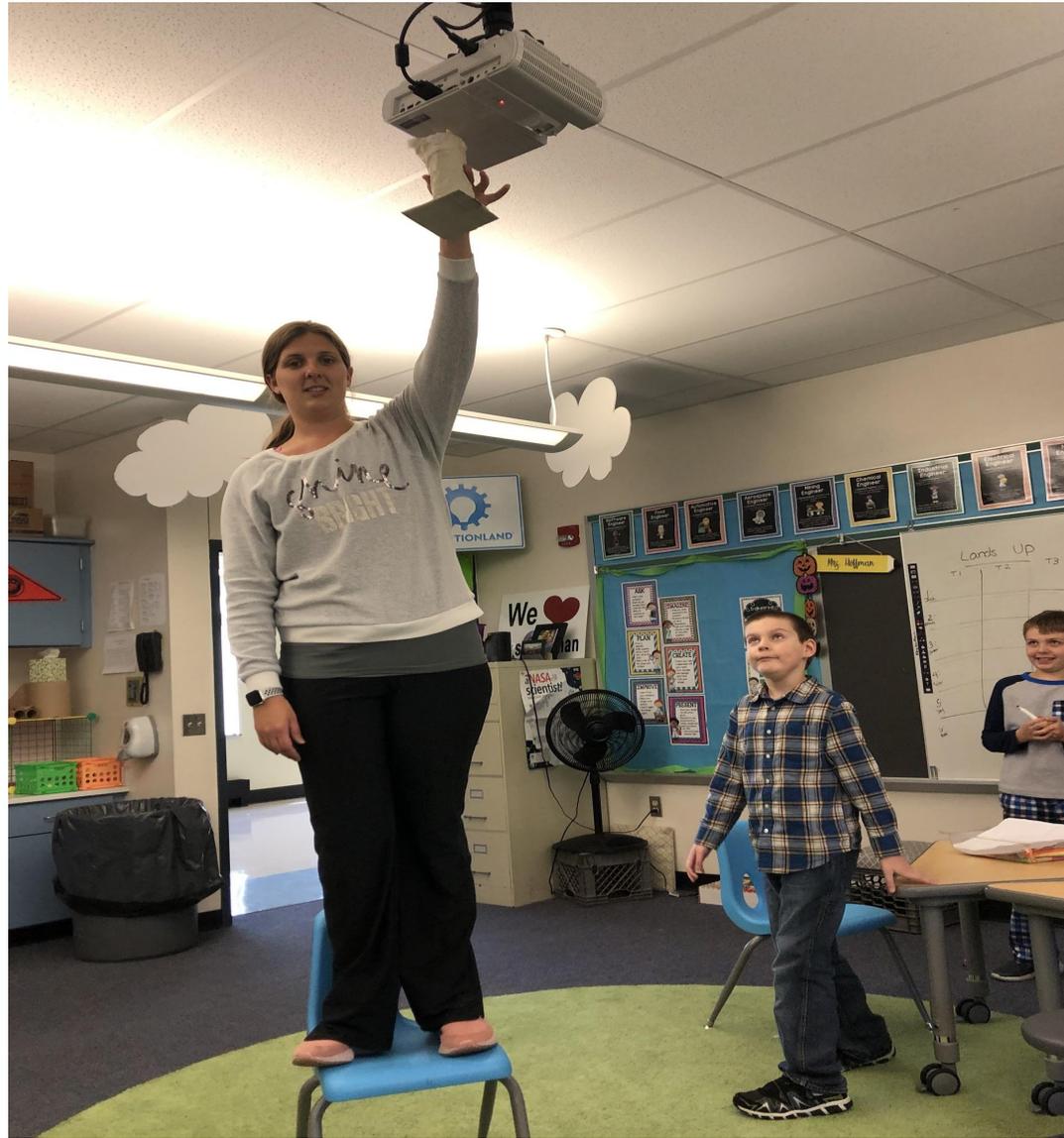
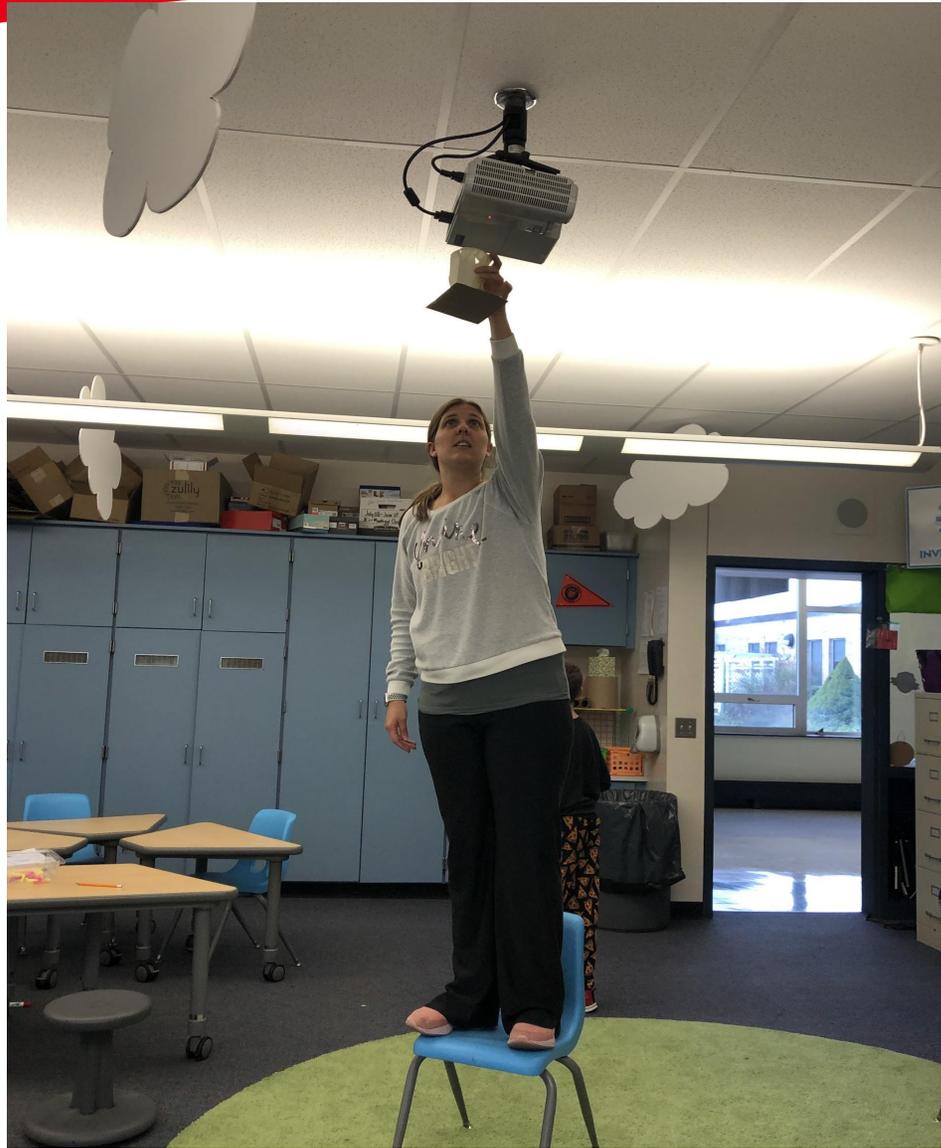
Notes, observations, and questions about my design:

Statements heard among my third graders:

- “The cotton balls should help the lander to land softly.”
- “We cut the index cards into smaller pieces so we could make more springs.”
- “We think the astronauts will come out of our cabin because the cup has no lid.”
- “The straws should act as supports if the lander tips over.”
- “Can we put cotton balls inside the cabin as well as the marshmallows?”
- “We decided to tape the cotton balls and springs to the bottom of the cardboard.”
- “We made extra cotton balls by splitting them in half.”
- “I really wish we could put a lid on the cabin!”
- “That is higher than what we were doing when dropping our lander.”

Test

Testing landers by dropping them from the ceiling!



Improve

My plan for redesign:

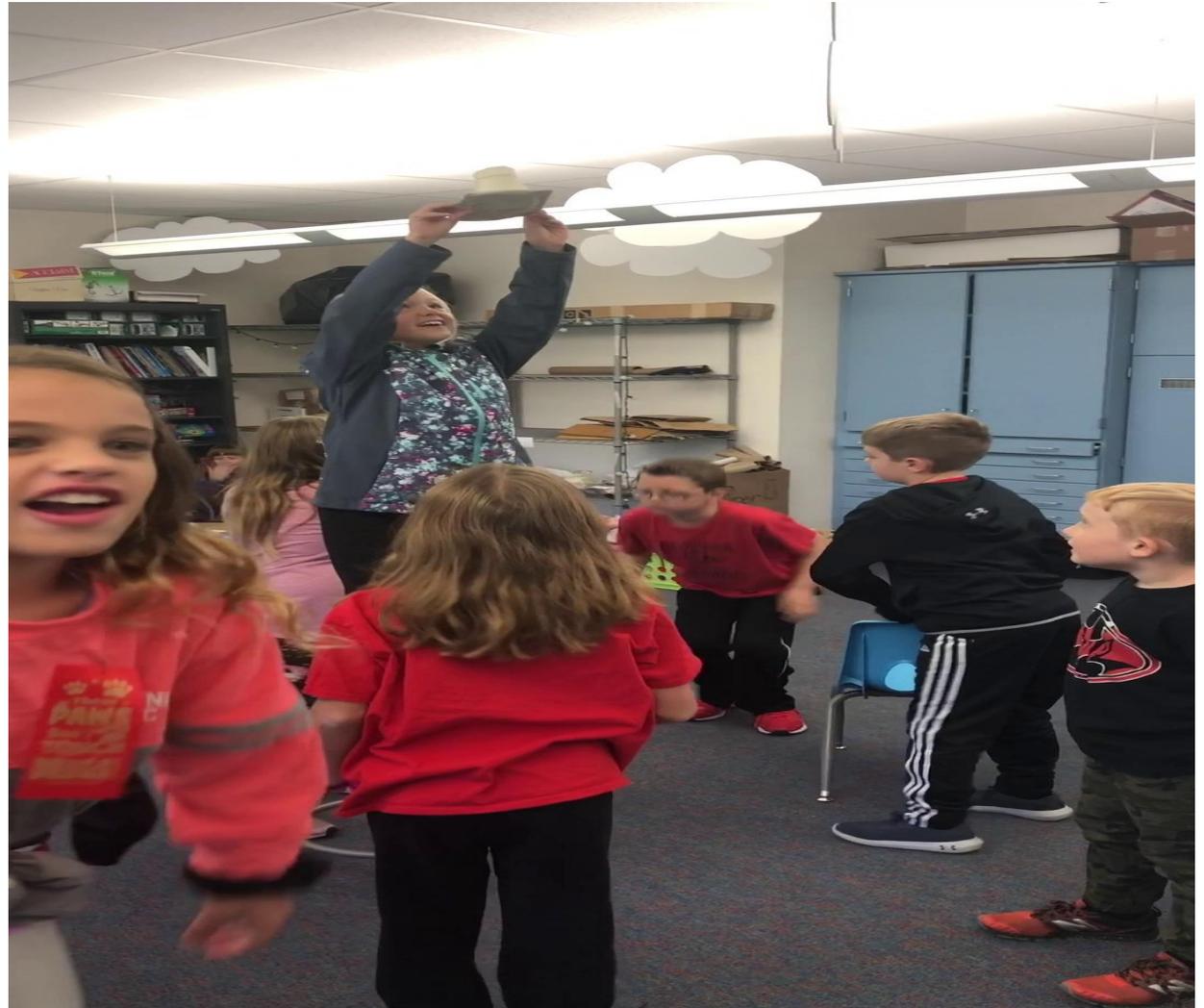
This video shows students testing their landers AFTER they made changes to their original design.

Keep:

- Most groups decided to keep the springs that they created out of the index cards as well as where the cotton was placed.

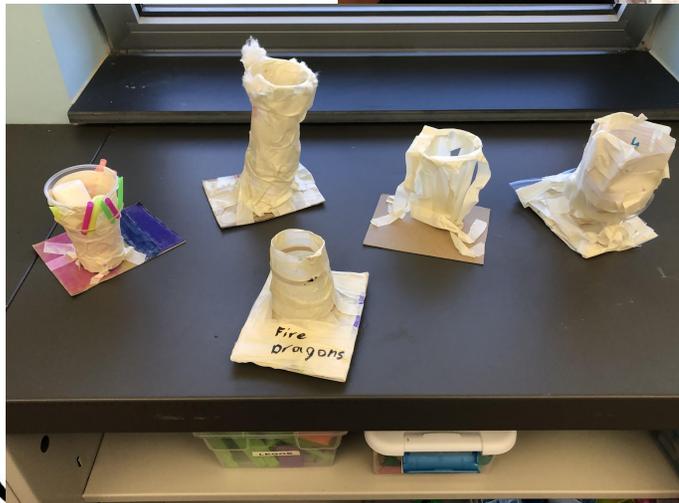
Change:

- Types of changes throughout the groups:
 - Flipping the cup over (because it was not allowed to have a lid and was placed upside down)
 - Adding a HUGE amount of tape
 - Increasing the length of the cup sides by using the straws since no lid was allowed



Share

Write to tell about this challenge. How did you use the engineering and design process?



From Team Fire Dragons (one of the winning teams)

Ask- We were asked how we could build a lander and then we asked in our heads how we could do it.

Imagine- We imagined our lander in our heads and then we started to draw it.

Plan- Each person drew what they imagined the lander to look like and then we compared all of ours. Mrs. Hoffman helped to decide which sketch we should try.

Create- We used our sketch as a guide when building our lander. Each person helped build either the cabin or spring landing pad.

Test- We tested by holding the lander above our heads and dropping it to see what happened. Mrs. Hoffman also dropped ours from the projector to see if it was good enough.

Improve- Ours tipped over! We decided to not use the straws but add more tape to make the cup not fall off. When Mrs. Hoffman dropped it again, ours was the only one that kept the astronauts in!

Share- We did not share ours but we did have to say what worked and what we had to change.

Reflect

- ★ Overall, I feel like the classes really responded to this design challenge. They were engaged the moment I showed them the moon landing clip from 1969. I also exaggerated and told them that their designs/results were going to be sent to NASA! The teams worked well together and really incorporated the use of shock absorbers (cotton and paper springs). They were quick to acknowledge that their initial design did not work and that they had to make improvements. When discussing at the end of the challenge, most everyone remembered what I first introduced about gravity and air resistance and how they played a part in the landing.
- ★ There were a few things that did not go very well. The first being that the students were so excited to start building their lander that they did not put effort into their sketches. It wasn't until I refused to give them their materials until I saw a nice blueprint of their design. Another challenge was that many groups did not listen to the initial directions about the cup not being able to have a lid. Many adjustments were made after that!
- ★ If I were to do this next year with my third graders, I would want to incorporate more math into the challenge. I was on a time constraint and did not extend the lesson into a fourth class. If I had more time, I would want to have the students time the lander's descents and find the average time to compare between groups.
- ★ I used the NASA Engineering Design Process for this challenge. One, because it was a NASA Design Challenge so the process fit in very nicely. Two, my third graders were able to understand each step of the process as it used words that they could identify, understand, and recall when asked. This is the process that I use most frequently in my STEAM lab with elementary students.

Reflect

Standards Covered:

Pennsylvania Science Standards

S4.A.1.3.1 Observe and record change by using time and measurement.

S4.A.2.1.2 Design and describe an investigation (a fair test) to test one variable.

S4.C.3.1.1 Describe changes in motion caused by forces (e.g., magnetic, pushes or pulls, gravity, friction).

S4.C.3.1.2 Compare the relative movement of objects or describe types of motion that are evident (e.g., bouncing ball, moving in a straight line, back and forth, merry-go-round).

S4.C.3.1.3 Describe the position of an object by locating it relative to another object or a stationary background (e.g., geographic direction, left, up).

Next Generation Science Standards:

MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

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

ISTE Standards

Knowledge Constructor

Innovative Designer

Computational Thinker

Pennsylvania Science as Inquiry Standards

Ask questions about objects, organisms, and events.

Understand that all scientific investigations involve asking and answering questions and comparing the answer with what is already known.

Plan and conduct a simple investigation and understand that different questions require different kinds of investigations.

Use simple equipment (tools and other technologies) to gather data and understand that this allows scientists to collect more information than relying only on their senses to gather information.

Use data/evidence to construct explanations and understand that scientists develop explanations based on their evidence and compare them with their current scientific knowledge.

Communicate procedures and explanations giving priority to evidence and understanding that scientists make their results public, describe their investigations so they can be reproduced, and review and ask questions about the work of other scientists.