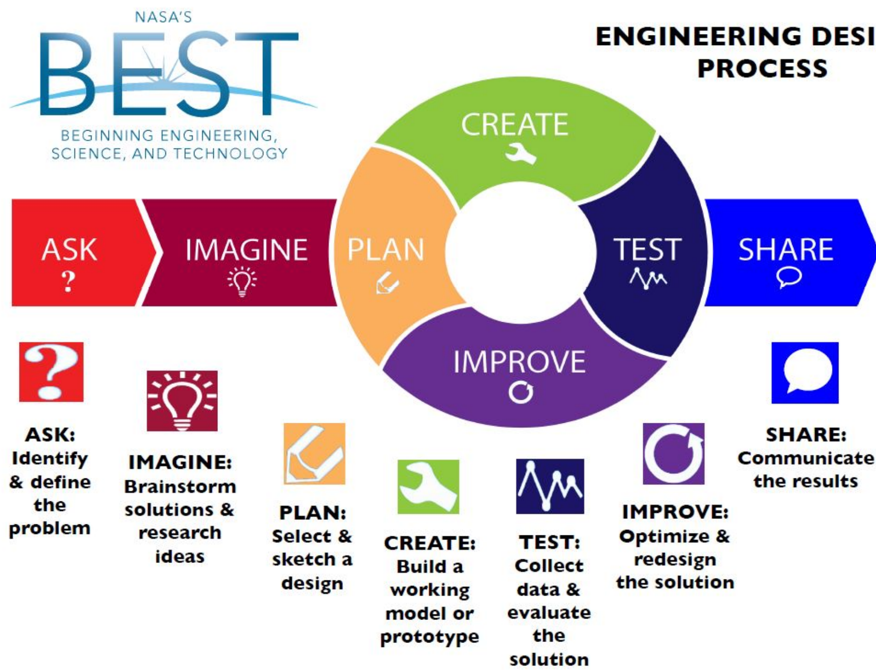
Engineering design Project Phase 2 - Implementation of Design an object to hit a target exploring propulsion

1. Design Process: NASA BEST



2. Implementation Timeline
    a. Create a design journal for students
    b. Share design journal with students, supply list and video links with background information - students will be participating in the activity virtually.
    c. Meeting 1 - Meet with students via zoom for an introduction to ask about what they know about rockets and how the different materials could be used to create a rocket that travels to hit a target at a specific distance. Have students brainstorm possible solutions and select a design, build the chosen design and test it. Discuss possible changes that could be made to improve the rocket
    d. Meeting 2 - Meet with students via zoom to have them work on making changes to the design and continue to test the different iterations to determine the best design for the rocket. Students will keep track of data such as the distance traveled and the path of the rocket to determine what changes could be made. Younger students will not necessarily be able to keep track of the data with accuracy and can discuss what they observed

visually. Students can view each other's rockets and their success in meeting the criteria of hitting a target through flipgrid videos.

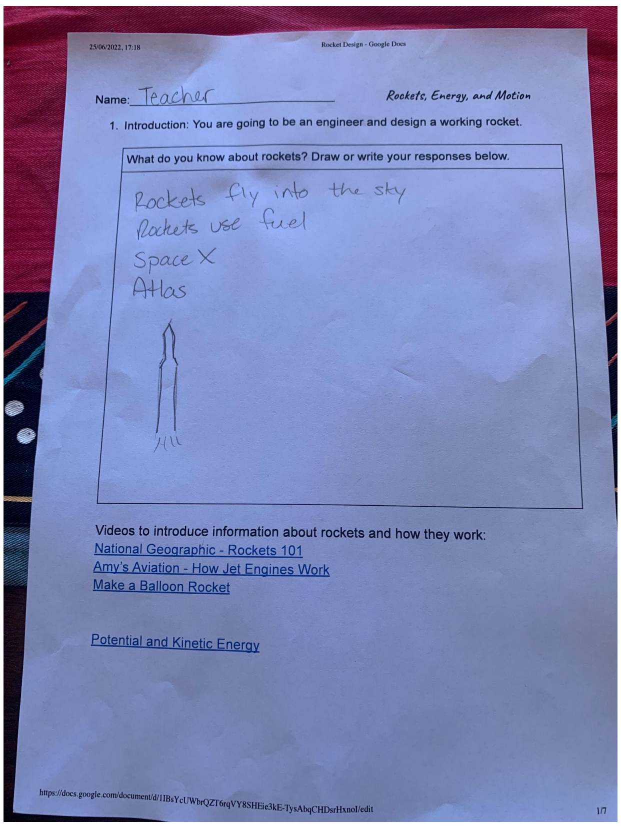
e. Meeting 3: Discuss the results and communicate what was successful and the overall engineering design process.

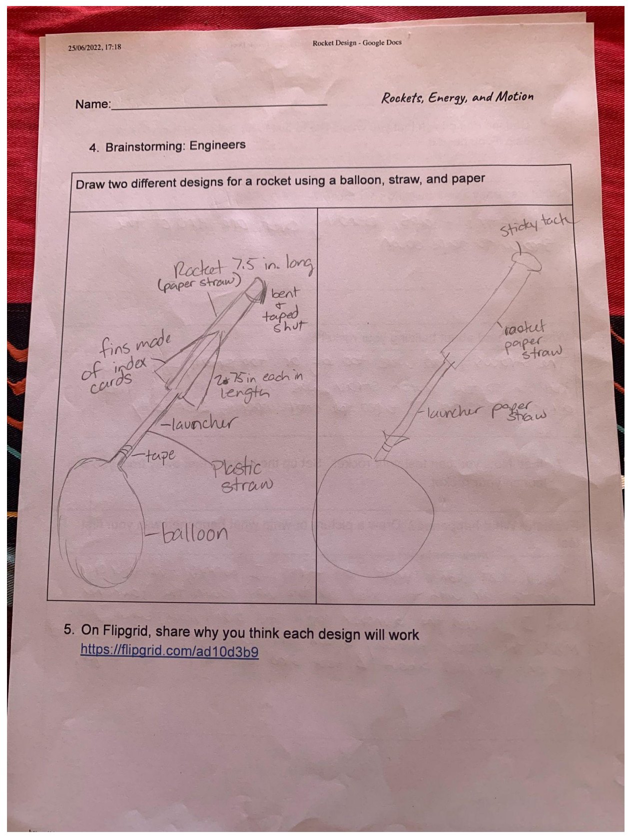
3. Design Notebook - Students will design a rocket and complete the Design Notebook as outlined here: Rocket Design

Sample items below:

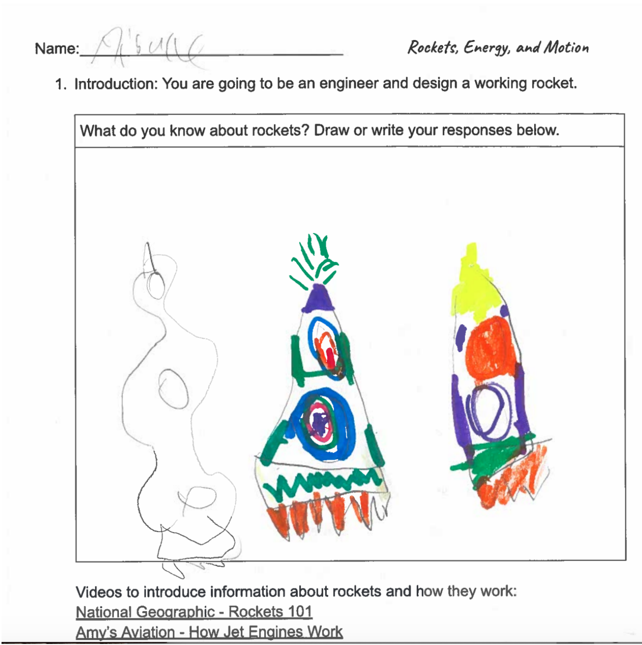
Teacher notebook

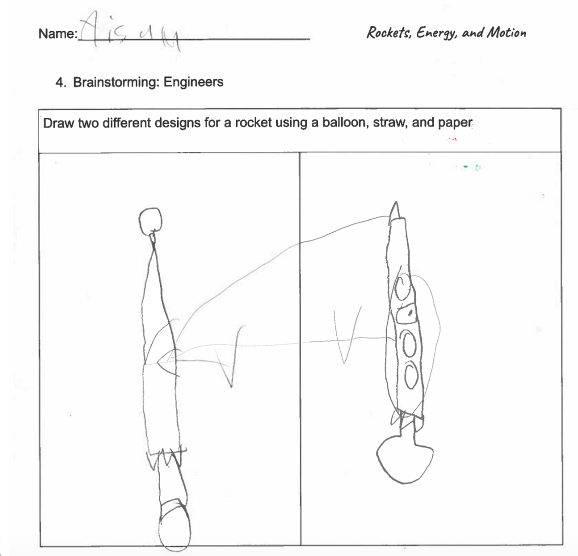
1)Asking questions and identifying the problem 2)Imagine/Plan



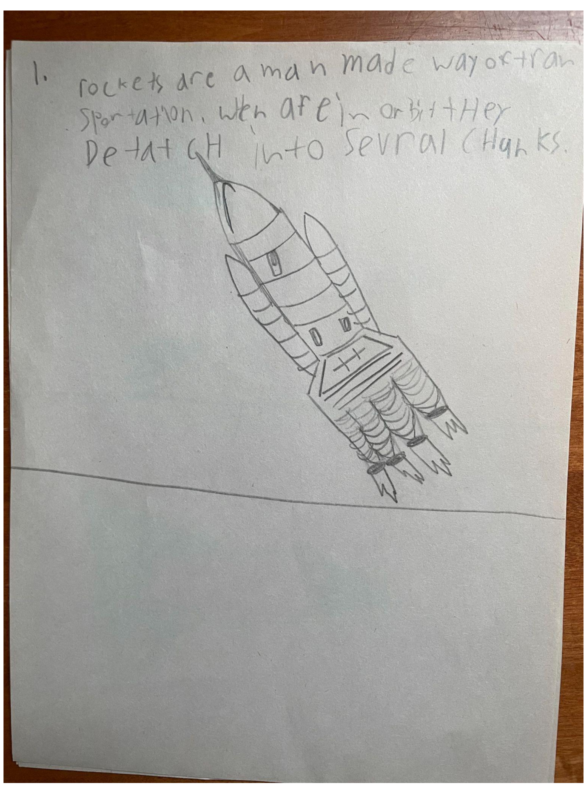


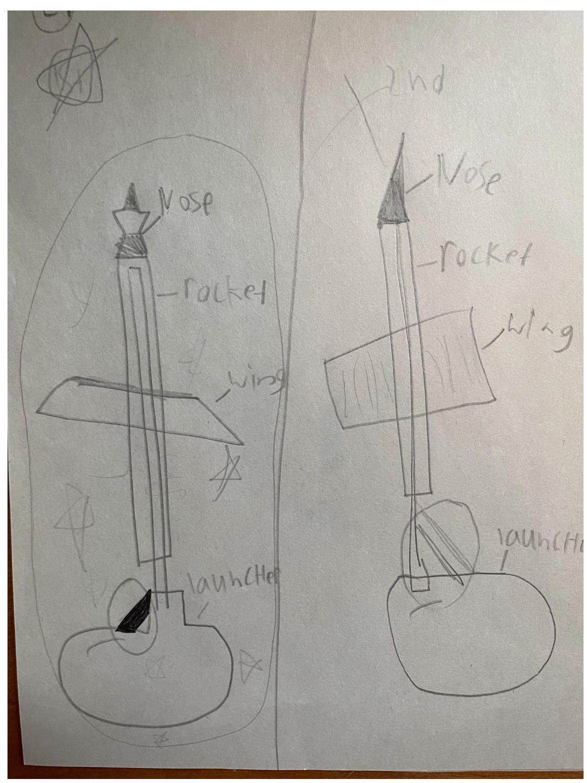
Student 1 (7 years old)
1)Asking questions and identifying the problem 2)Imagine/Plan





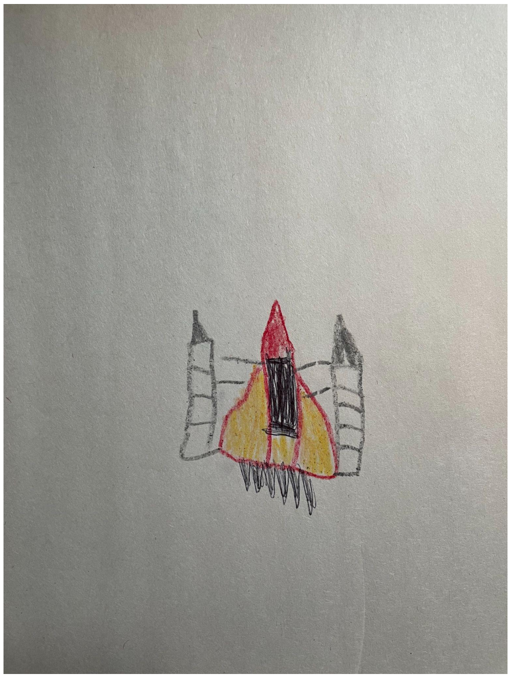
Student 2: (10 years old)
1)Asking questions and identifying the problem 2)Imagine/Plan

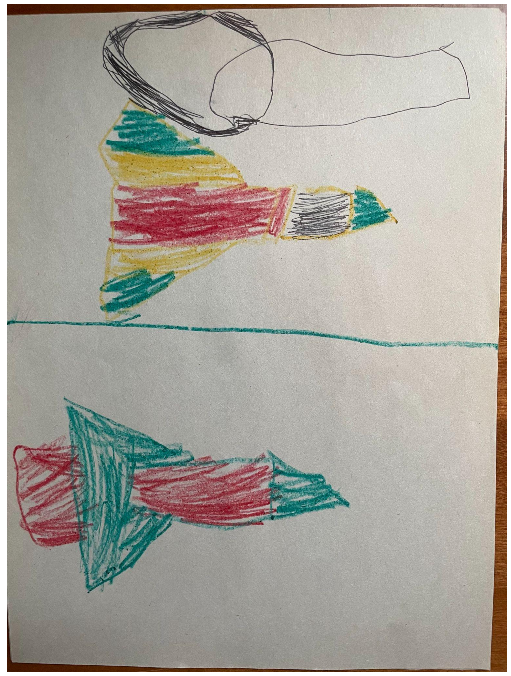




Student 3: (6 years old)

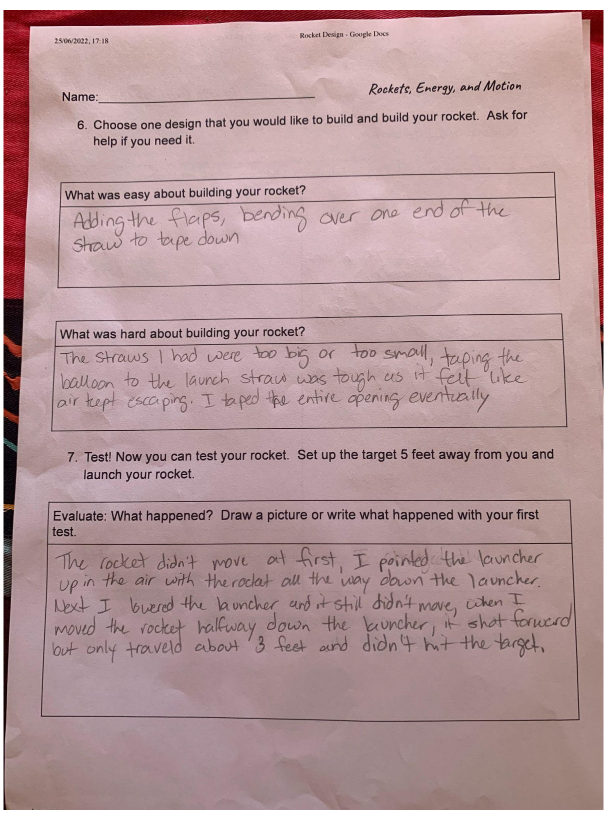
1)Asking questions and identifying the problem 2)Imagine/Plan





Teacher Notebook

3) Create, Test



25/06/2022, 17:18 Rocket Design - Google Docs

Name:______________________ *Rockets, Energy, and Motion*

6. Choose one design that you would like to build and build your rocket. Ask for help if you need it.

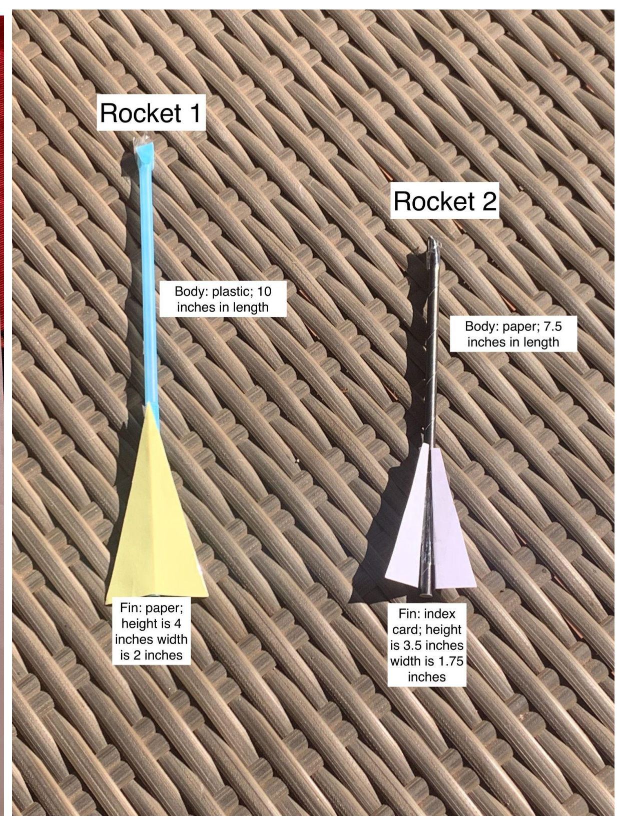
What was easy about building your rocket?
Adding the flaps, bending over one end of the straw to tape down

What was hard about building your rocket?
The straws I had were too big or too small, taping the balloon to the launch straw was tough as it felt like air kept escaping. I taped the entire opening eventually

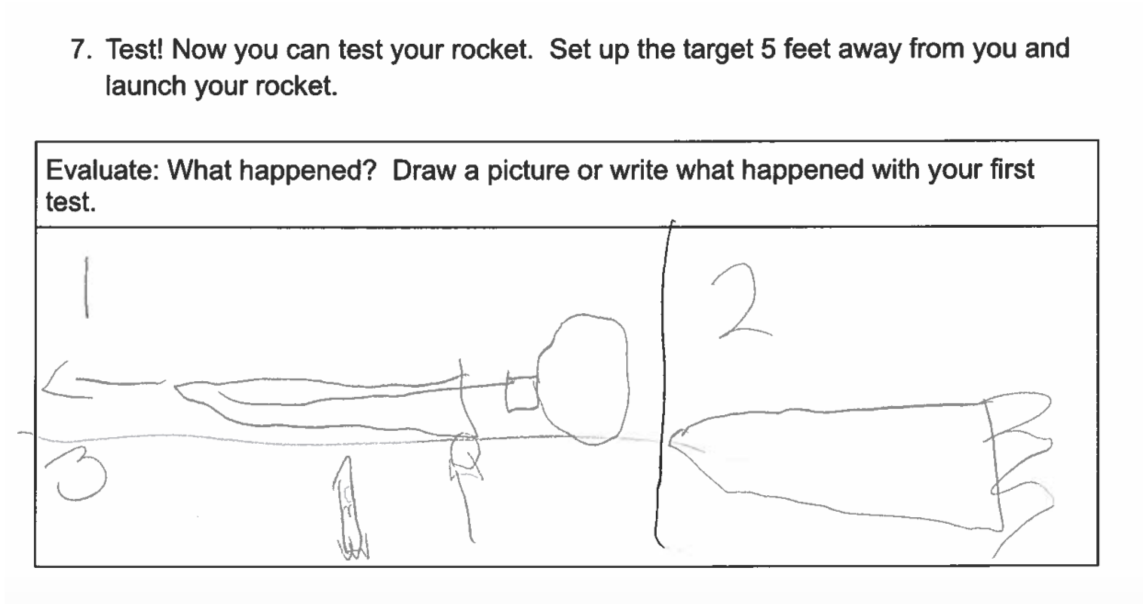
7. Test! Now you can test your rocket. Set up the target 5 feet away from you and launch your rocket.

Evaluate: What happened? Draw a picture or write what happened with your first test.
The rocket didn't move at first, I pointed the launcher up in the air with the rocket all the way down the launcher. Next I lowered the launcher and it still didn't move, when I moved the rocket halfway down the launcher, it shot forward but only traveld about 3 feet and didn't hit the target.

4) redesign



Student 1 (7 yr old): As the student struggles to write in English (Spanish immersion learner), she spoke about it being easy to blow up the balloon and that it was hard to get the rocket to move far off of the launcher.

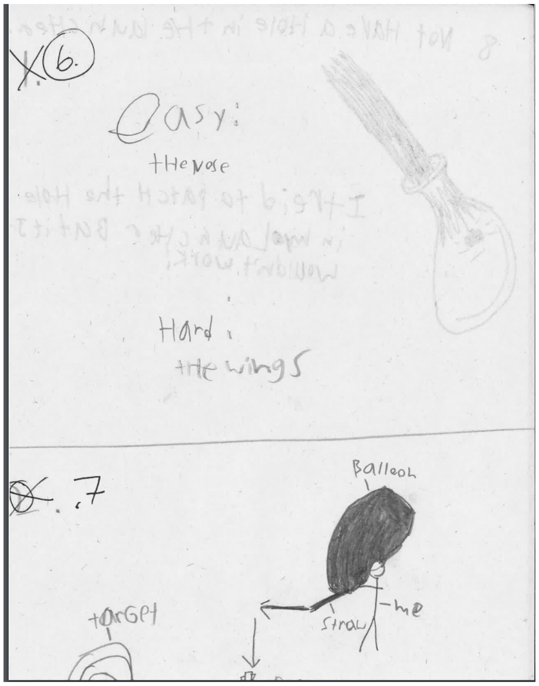

7. Test! Now you can test your rocket. Set up the target 5 feet away from you and launch your rocket.

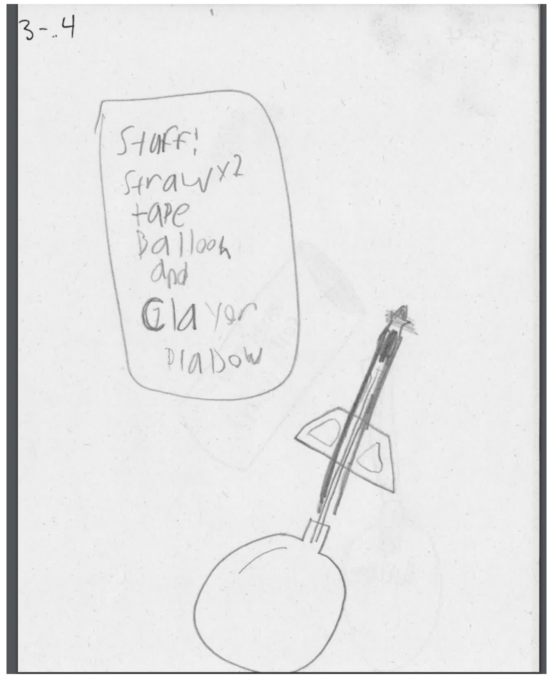
Evaluate: What happened? Draw a picture or write what happened with your first test.
1 2 3

Student 2 (10 yr old):
The student said that the first straws that were used were too heavy as they were made of thicker plastic. The rocket was easy to make, but the launcher was hard because he had to make sure the air didn’t escape the balloon and straw. When he rebuilt the launcher, he put tape around the entire balloon opening, and this helped reduce escaping air.

create /test redesign

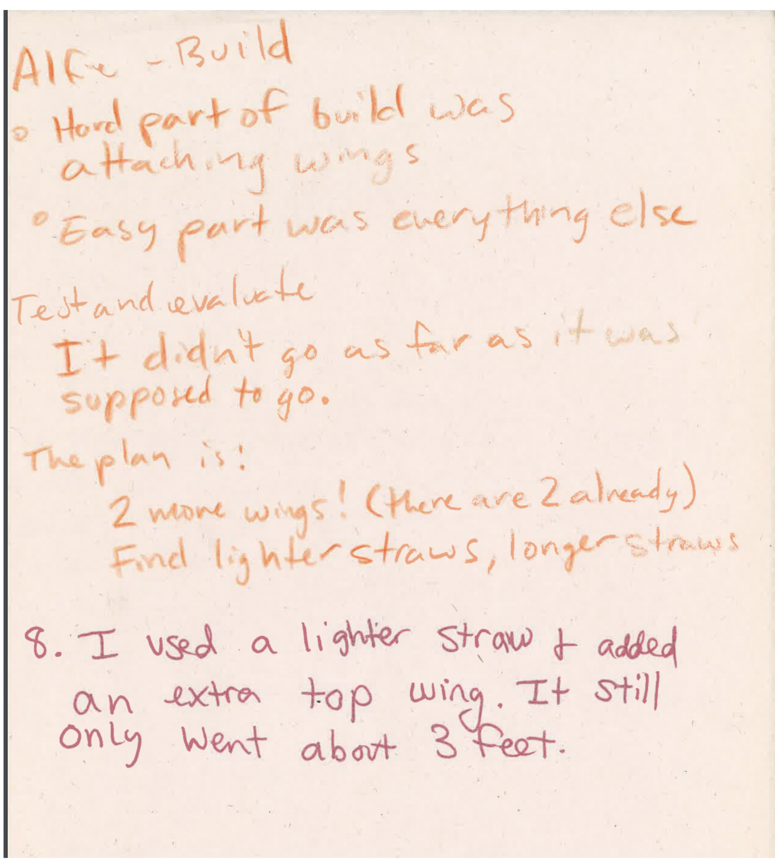
Images on next page





Student 3 (6 yr old)

Create/test, redesign, and evaluate written by a parent after discussion with the student.



Alfie - Build

- Hard part of build was attaching wings
- Easy part was everything else

Test and evaluate

It didn't go as far as it was supposed to go.

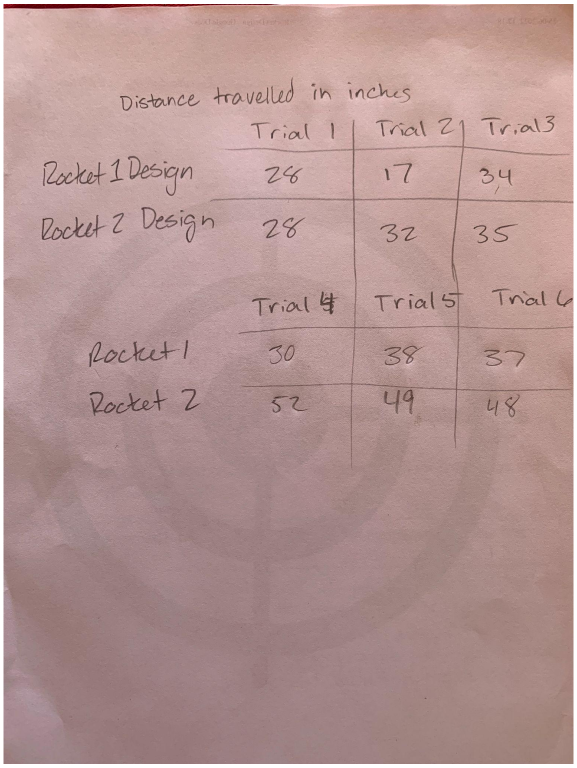
The plan is:

2 more wings! (there are 2 already)
Find lighter straws, longer straws

8. I used a lighter straw + added an extra top wing. It still only went about 3 feet.

Teacher Notebook

5) data

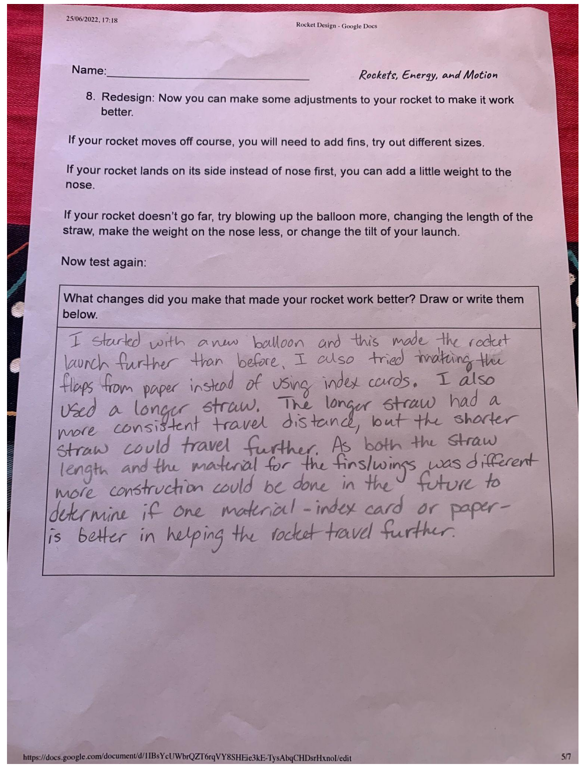


Distance travelled in inches

	Trial 1	Trial 2	Trial 3
Rocket 1 Design	28	17	34
Rocket 2 Design	28	32	35

	Trial 4	Trial 5	Trial 6
Rocket 1	30	38	37
Rocket 2	52	49	48

6) evaluate



25/06/2022, 17:18 Rocket Design - Google Docs

Name:______________ *Rockets, Energy, and Motion*

8. Redesign: Now you can make some adjustments to your rocket to make it work better.

If your rocket moves off course, you will need to add fins, try out different sizes.

If your rocket lands on its side instead of nose first, you can add a little weight to the nose.

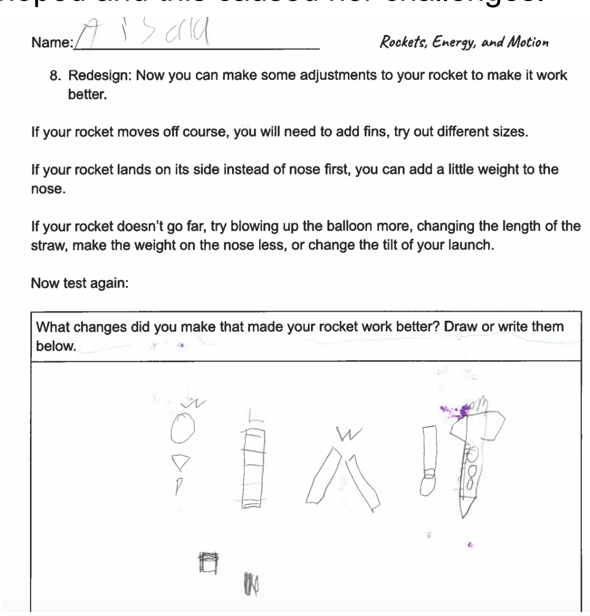
If your rocket doesn't go far, try blowing up the balloon more, changing the length of the straw, make the weight on the nose less, or change the tilt of your launch.

Now test again:

What changes did you make that made your rocket work better? Draw or write them below.
I started with a new balloon and this made the rocket launch further than before. I also tried making the flaps from paper instead of using index cards. I also used a longer straw. The longer straw had a more consistent travel distance, but the shorter straw could travel further. As both the straw length and the material for the fins/wings was different more construction could be done in the future to determine if one material - index card or paper - is better in helping the rocket travel further.

https://docs.google.com/document/d/1IBsYcUWbrQZT6rqVY8SHEic3kE-TysAbqCHDsrHxnol/edit 5/7

Student 1 (7 yr old): The student came up with possible ideas for redesign. She added fins to her rocket (W) to make it go further. Her data shares the distance traveled, and a parent added the average data. This was not an expectation for students. This student was frustrated with the testing process as the rocket would not travel as far as she had hoped and this caused her challenges.



Name: Aisaldi *Rockets, Energy, and Motion*

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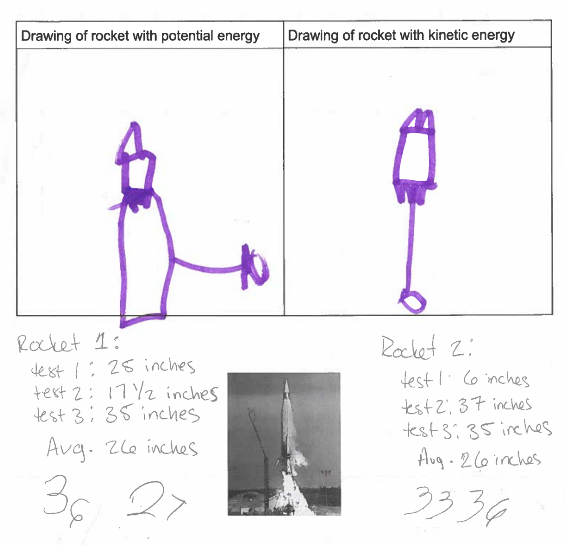
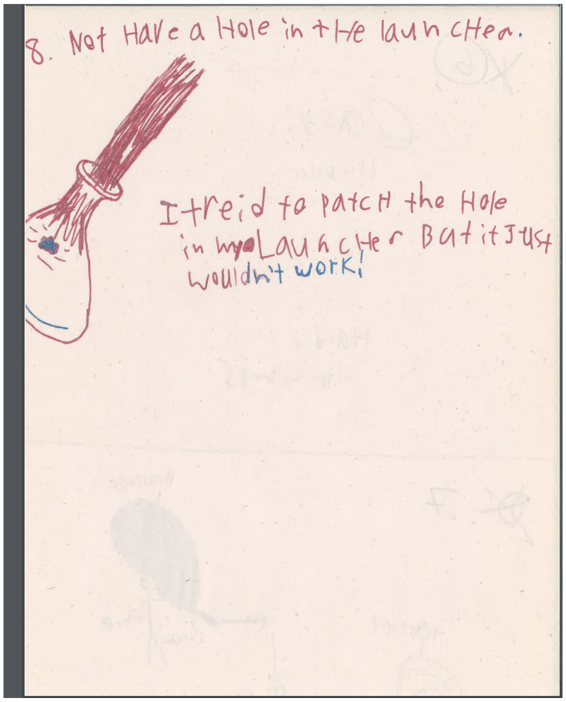


Drawing of rocket with potential energy	Drawing of rocket with kinetic energy

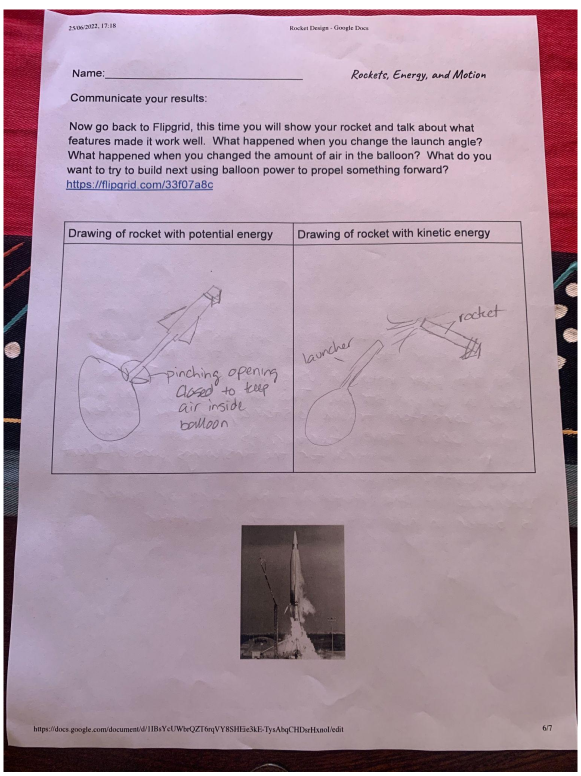
Rocket 1:
test 1: 25 inches
test 2: 17 ½ inches
test 3: 35 inches
Avg. 26 inches
36 27

Rocket 2:
test 1: 6 inches
test 2: 37 inches
test 3: 35 inches
Avg. 26 inches
33 36

Student 2 (10 yr old)
Evaluate



Teacher Notebook
7) communicate and understanding of PE vs. KE



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Name:______________________________ *Rockets, Energy, and Motion*

Communicate your results:

Now go back to Flipgrid, this time you will show your rocket and talk about what features made it work well. What happened when you change the launch angle? What happened when you changed the amount of air in the balloon? What do you want to try to build next using balloon power to propel something forward?
https://flipgrid.com/33f07a8c

Drawing of rocket with potential energy	Drawing of rocket with kinetic energy
pinching opening closed to keep air inside balloon	launcher; rocket

https://docs.google.com/document/d/1IBsYcUWbrQZT6rqVY8SHEie3kE-TysAbqCHDsrHxnoI/edit 6/7

Student 1 (7 yr old) Response:

Video link also viewable here:
https://drive.google.com/file/d/13K4p0uxhBlcYj4MMepfo49Yhu35IAgxK/view?usp=sharing

Students 2 and 3 had challenges using Flipgrid to upload their responses. Unfortunately, I was not able to record our discussion as the file was corrupted. Student 2 showed a good understanding of potential energy and discussed that this was different based on how much the balloon was inflated. Both students 2 and 3 could describe kinetic energy as the moving of the rocket.

4. Reflection:
    a. What went well with the engineering design challenge?

        I think that the challenge was engaging for students. They wanted to explore how they could make a rocket and had a lot of varied ideas. Student 2, the 10-year-old, in particular, commented that he thought he had a better understanding of potential and kinetic energy by seeing it in action. He really enjoyed that the project allowed him to include his ideas instead of just being given step-by-step directions on exactly what to do. He found this to be more challenging which for him meant he was more engaged and interested in the activity

    b. What did not go well with the engineering design challenge?

        It was a challenge to do this activity virtually as it was difficult to ensure that all students had the appropriate materials and when they initially struggled they really were hard on themselves that the rocket didn't work as expected. It was hard to continue to encourage them to persevere with the challenge as I was not with them in the same space at all times as they worked on the project. It also required parental involvement (with this age group) which was not always easy for parents.

    c. What concepts were covered?

        This project covered concepts related to measurement and energy, specifically potential and kinetic energy and distance. The process of engineering was also discussed in depth. These students did not have as much practice going through a documented design process. We did discuss how with many play activities they do use elements of design as they build, test, and evaluate how what they make works for a specific purpose.

    d. How did the ED process help teach science and mathematics?

        Students were able to develop some understanding of potential and kinetic energy. Even the youngest learner was able to explain that the rocket moving showed kinetic energy. The oldest learner had heard the terms before this activity but did not know what they meant. Now he does and is excited to try out other rocket activities he has found online. For mathematics, the two older students were able to discuss how far the rockets traveled and share how they thought the design affected the distance traveled. The younger student also used measuring tape to identify distance, but developmentally was not as able to make the connections of the design to the distance traveled. It allowed the students to make real-world connections to measurement.

e. Did I choose an appropriate engineering design process? Should I simplify or make it more complex?

   This was a challenge as students were in varied age groups that completed the activity. I think that this was a bit challenging for the 6-year-old and that parts could be further simplified. I also think that the 10-year-old could have been challenged further to make comparisons of the distance traveled by the rockets. This seemed to work well for the 7-year-old with the ability to share her ideas verbally. The option to write, draw or record what they had done made the activity more accessible to all of the students. Unfortunately, there were technical challenges for some students with video.

f. How can I improve this activity with future students?

   In the future, I think that this activity would work better in person as opposed to virtual. This would allow the teacher to troubleshoot as students had challenges with recording different aspects of the journal. I feel that this can still be done with varied age groups, but with younger learners, I would further adjust the language and discuss kinetic energy simply as energy when things move. Potential energy seemed to be a more challenging concept for the younger learner which makes sense with his developmental stage. Also, if done in person, students who were progressing through the activity faster and had a better grasp of the concepts would have an opportunity to extend their learning by providing the opportunity to construct other objects such as a balloon-powered car and also to introduce the concept of speed or velocity.