

Major Project: Engineering Design Challenge

Phase II - Implementation

Big Idea: The engineer design process is used by anyone to solve problems and create inventions. The design elements of an object will determine its performance

The students will use the *Nasa's Engineering Design Process* to design and build different airplanes. They will test, make observations, collect data and make improvements to their design if needed.

Develop an implementation timeline.

Review Before introducing the Design Challenge

This lesson was done with first graders. This was the first time the students were exposed to the engineering design process.

I began the project by introducing the Engineering Design Process and explained the different steps that engineers take to solve a problem or create an invention. I showed the students videos to strengthen the understanding of the design process. Nasa: Nasa for Kids: Intro to Engineering https://www.youtube.com/watch?v=wE-z_TJyzil.

Next, I introduced the Engineering Notebook and explained to the students that this is where engineers recorded all of the information when they are solving a problem or creating an invention.

Because the students doing this project were girls, I thought it would be the perfect opportunity to read the book, "Rosie Revere the Engineer".

Using NASA videos and How Do Planes Fly? We discussed the four forces that keep an airplane in the sky. They were lifted, weight, thrust, and drag. The students observed the four forces which keep planes in the air by watching. NASA - How to drag, lift, and thrust work. <https://www.youtube.com/watch?v=a5dzfWOb0xo>

Introducing the Challenge using the G.R.A.S.P Method

Goal - To introduce the challenge I told the students they would be engineers. Their task is to design two model airplanes. The plane that will be used will be the plane that will go the farthest.

Role – The girls will be part of an all-girls engineering team that has been asked to work on a special airplane project. To assist them in their plan they need to think of all of the four forces that keep an airplane in the sky.

Audience- The students will be designing, building, and testing their planes outside. The audience will be their parents and peers. They will present the aircraft that flies the farthest to an airline company that is interested in using planes designed by girls.

Engineering design activity with students

Situation- As an engineer, the students will use an *Engineer Design Notebook* – (See attached) this is where they will be recording their steps to creating their planes, and design an aircraft that will go farthest. (See Engineer Notebook Attachment)

Step 1: Identify the problem (How can I make a plane and how to make it go far)

Step 2: Brainstorm and sketch their designs.

Step 3: Design your plane.

Step 4: Build your plane.

Step 5: Test and Evaluate- Collect data by measuring the distance your plane flies

Step 6: Redesign- Make modifications to your aircraft to try to make it go farther.

Step 7: Share the plane that goes the farthest and the solution used to make modifications.

Products- After they determine the plane that goes the farthest, they will test them out and present them to the airline company's "Air Show."

Reflection

- a. What went well with the engineering design challenge: By engaging the students at the beginning by showing Nasa: Nasa for Kids: Intro to Engineering, helped the students understand what an engineer does. Also showing the Nasa video on How Planes Fly helped the students realize the four requirements make a plane fly. Before they didn't know what caused a plane to fly. The book Rosie Revere, Engineer that is about women in aviation. The book also showed images of the young engineer designing and making modifications and persevering after her original plane didn't fly. The students enjoyed building and testing their aircraft.

- b. What did not go well with the engineering design challenge? Because the students were Kindergarteners and first graders, I think it was too much information at one time. With it being summer also they were the only students that I had to do the challenge with and I had to do it in one day. I think it would have gone better if I could have explained the engineer design process over a length of time. I think it would have gone better also if the students had more time to research different planes.
- c. What concepts were covered (list standards and topics where appropriate)

Engineering

K-2-ETS1-1.

Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

K-2-ETS1-2.

Modeling in K-2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions..

sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

K-2-ETS1-3.

Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Math: CCSS.MATH.CONTENT.2.MD.A.1

Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

CCSS.MATH.CONTENT.2.MD.A.2

Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.

CCSS.MATH.CONTENT.2.MD.A.3

Estimate lengths using units of inches, feet, centimeters, and meters.

CCSS.MATH.CONTENT.2.MD.A.4

Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit

K-PS2-1 Motion and Stability: Forces and Interactions

Plan and investigate to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object

Technology 1.0-D-1 (Design and make things with simple tools)

- d. How did the ED process help teach the science and mathematics concepts?
The math concepts covered in this process were symmetry when building the plane, measurement using inches and non-standard analysis by measuring the distance of the planes' flights by using their feet. Estimating how much longer one object is than another and comparing the differences. By flying their aircraft, it helped with science concepts. The students could examine the effects of the different strengths or different directions on an object because the wind was blowing and it was affecting their planes distances.
- e. Did I choose an appropriate engineering design process? I think the Nasa Design Process, is applicable for students K-2, but it needs to be taught in stages. Each stage should be explained for at least a couple of days for the students to have a good understanding and the importance of each step of the process.
- f. How can I improve this activity to use with future students? I could improve this activity by spending more time on the engineering design process. This activity could also be enhanced by allowing the students to research different types of planes and spacecraft.

Student Engineer Notebook

Adventure in measurement
and the engineering design
process



Name Abby
Date 7/5

Name _____

Airplane Measureme

Identify the problem

1. What is your purpose?
Airplane
2. What do you want to know?
how far will it go.

Brainstorming

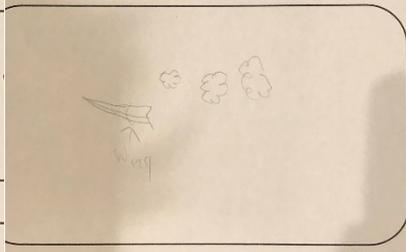
Which type of airplane will you make
fast paper

How far do you think your airplane
travel?
kind of far

Design

What materials will you need?
Paper

Draw a diagram for your paper airplane.



Name _____

Airplane Measurement

Create

Now, gather your materials and create your airplane. Remember to follow the steps you listed and have fun!

Test it Out

1. How far did your plane go on your first try?

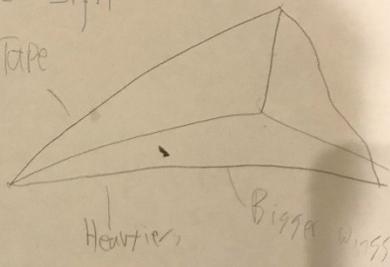
102 in

Do you feel that your design was successful? Explain your thoughts.

No wind blew it fell apart

Redesign

Tape



Heavier

Bigger wings

Share solution

How far did it travel on the second try?

176 in

Do you feel that your design was successful? Yes

Explain your thoughts?

Maybe it's heavier with bigger wings and
worked better. The wind stopped blowing.