

**Shonda Baggette**

## **Engineering Design Challenge**

### **Phase 1 - Research and Planning**

#### **Lesson Summary**

Students will use the Engineer Design Process to design and fly a plane.

The teacher will tell the students they will be aeronautical engineers; their job is to follow the engineering design process to design airplanes that will meet specific standards. They will design three model airplanes that will meet the requirements and restrictions that are necessary to achieve the goal of this mission. Students will be given materials and will determine the best way to use and combine these materials to meet the goals of which plane goes farthest. They will then present their designs to NASA, engineers to determine if they can use on the next mission.

#### **Big Idea -**

The engineer design process is a used by anyone to solve problems and create inventions.

The design elements of an object will determine its performance.

#### **Standards:**

##### **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 group 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

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

### **Types of Problem solving needed:**

This lesson will be for second graders. Most of the students will have Declarative knowledge of the "Facts", of what an airplane is and that it flies. Some but not all will have "Concepts that there are different types of planes and can determine which would go faster and furthest. Not many of the students will know the "Principles" of what makes the plane fly and how it stays in the air. Because of the students lack of "concepts" and "principals" of airplanes, they will research from NASA resources such as videos, books and diagrams to help in their problem solving. After they gain declarative knowledge, I will alternate instruction to procedural knowledge. I hope to integrate declarative and procedural problem solving throughout the unit. The students will be required to solve moderately structured problems. For example, they will not have step by step instructions on making the plane. After researching and gathering data about airplanes, they will have the

knowledge to use different strategies and make modifications to reach their goal.

### **Objectives and Concepts-**

- Students will use the engineering design process to design airplanes that meet specific standards.
- Students will measure to compare distances of their planes.
- Students will improve their plans and make modifications based on testing results.

### **Activities**

The "NASA Knows" site provided me with resources for designing paper planes

I used "How do Planes Fly" from this site to explain and the four forces that keep an airplane in the sky.

- The teacher will introduce the lesson with these Questions: What do Spacecraft Designers do and what they should think about when designing a plant.
- The teacher will show a video about Spacecraft Designers from the NASA site.
- The students will pretend to be Spacecraft Designers and design airplane models' airplanes that will meet specific criteria.
- The teacher will tell the students and demonstrate a sample of an Engineering notebook to the students. She will explain to the students that they will be documenting the Engineering Design process in this notebook.
- The teacher will tell the students that the problem is that the plane needs to go as far as possible.

- The students will collect and review information about how an airplane flies and the aerodynamics of a plane.
- The students will brainstorm ideas and draw their design.
- The students will build their plane.
- The students will test and evaluate their plane, measure the distance it flew, and collect data
- The students will make redesign and modifications if needed.
- The students will share their results by creating an advertisement for NASA. They will argue why they think their plane is the best for NASA to use.