



Lesson 5: Going the Distance

Grade: 3rd-8th

Duration: 45 minutes

Standards:

- *Common Core Mathematics* – Measuring length and representing and interpreting data graphically.
- *NGSS Engineering Design* – Define a problem, develop and test a model or solution using appropriate materials. Compare a solution with others to determine the best solution.
- *NGSS Nature of Science* – Scientific understanding is based on empirical knowledge gained from conducting experiments, gathering data and analyzing results.

Objective:

- Students will build and test different types of paper airplanes. They will use graphical data to interpret how airplane design affects the distance it travels.

Key Vocabulary:

- independent variable, dependent variable, line graph, scatter plot, mean, quantitative data, qualitative data

Recommended Prior Knowledge:

- basic graphing skills such as X- and Y- axis, origin, scale, plotting points, interpreting graphs, calculating mean

Materials:

- pictures of different types of airplanes (as printout or for projection), 8.5 x 11 inch paper, paper airplane instruction printouts or folding templates of different airplane designs, scissors, tape, chart paper or whiteboard with X, Y graph drawn, markers, tape measure or yard sticks

Additional Resources:

- [Paper Airplane Depot](#) website for paper airplane instructions and troubleshooting tips

Procedure:

1. Show students pictures of different types of airplanes such as fighter planes, passenger planes, bombers, cargo planes, small propeller engine planes, etc.
2. Ask students to make observations of each type of plane and make an argument based on observation for the airplane's purpose. (Example: A cargo plane is good for carrying lots of stuff because it has a very big body and the wings look stout and sturdy.)

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3. Introduce the design challenge for the day and that the objective is to investigate different types of airplane designs and their functions.
4. Work with students to develop a record keeping system that utilizes an X, Y coordinate system to mark the flight distance (independent variable) of each type of plane (dependent variable). Record each type of plane as a different color marker in order to see trends in flight patterns. In addition to the X, Y graph, you may also keep a box beside the chart for students to fill in with observations of flight quality. Use this as an opportunity to discuss the difference between quantitative and qualitative data.
5. Divide students into groups and assign each group a different type of airplane to create. Students will follow instructions to each create a type of paper airplane. Examples of paper airplane patterns include Dart, Bullet, Delta Wing, Harrier, Glider, etc.
6. Students should take turns launching their airplanes from the end of the tape measure and recording the distance (quantitative data) and flight characteristics (qualitative data) such as whether or not the plane flew straight, spun, flipped over, took a nosedive, etc.
7. Students should conduct at least three trials and record the data. This is an opportunity to discuss the importance of conducting multiple scientific trials.
8. If time and ability allow, have students work with their group to calculate an average flight distance for their type of airplane. Use this as an opportunity to discuss variation within tests. For example, did the same person launch the plane the same way every time?
9. Wrap up by reviewing the class data chart. Discuss the trends in flight patterns and identify which type of design would be best suited for a certain purpose such as fighter planes, passenger planes, bombers, carrier planes, etc. and why.

