

# Classroom Activities: Flying High! Using paper airplanes in middle school mathematics

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## Abstract

With state and national standards growing each year, it has become essential to group multiple concepts into a single unified unit. When that unit utilizes an activity that students view as fun, the learning process becomes natural. Students enjoy making paper airplanes and with some creativity, teachers can use this to their advantage. By incorporating multiple standards into one unit, the teacher frees up more time to cover other material.

## 1 Introduction

This activity covers multiple Alabama state standards. The sixth grade standards addressed are: 1) Demonstrate computational fluency with addition, subtraction, multiplication, and division of decimals and fractions; 2) Solve problems involving decimals, percents, fractions, and proportions; 9) Convert units of length, weight, or capacity within the same system; and 10) Interpret information from bar graphs, line graphs, and circle graphs. The seventh grade standards addressed are: 6) Solve one- and two-step equations; 11) Solve problems involving ratios or rates, using proportional reasoning; and 12) Determine measures of central tendency (mean, median, and mode) and the range using a given set of data or graphs, including histograms, frequency tables, and stem-and-leaf plots. The eighth grade standards addressed are: 1) Use various strategies and operations to solve problems involving real numbers and 13) Interpret data from populations, using given and collected data Alabama State Department of Education (2003).

In addition to covering multiple state standards, this activity covers national expectations for grades 6-8. After completing this activity the students should be able to: work flexibly with fractions, decimals, and percents to solve problems; develop meaning for integers and represent and compare quantities with them; represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic rules; relate and compare different forms of representation for a relationship; understand both metric and customary systems of measurement; understand relationships among units and convert from one unit to another within the same system; select, create, and use appropriate graphical representations of data, including histograms, box plots, and scatterplots NCTM (2000). This activity will also cover several of the national process standards.

## 2 Activities

### 2.1 Research

The first task I have my students complete is research airplane designs. I assign the students about five websites to visit to get ideas for the construction of their plane. It is important that the technology coordinators clear the websites that I assign. I also ensure that the link I provide the student directs them to the

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exact page I want them to view so time is not wasted searching for the page I want them to be on. Every year I double-check the links to ensure the validity. The best way for the students to access the links is by creating a bookmarking website so all the students have to remember/write down is one website and then they can navigate off of it. My bookmarking website for airplane designs is: (LINK)

## 2.2 Test Flying

The next task that I have the students complete is the test flying of the airplanes. I take my students either to the gym or outside where they can test fly their airplanes. While other groups are testing theirs, groups that have previously tried theirs can make alterations or completely rethink their design.

## 2.3 Flying

After all groups are satisfied with their aircrafts, the students go outside for the actual flying. I have the students do all the measuring themselves. I will put a piece of tape down on the ground to mark as the starting line. One student will need to measure distance while another uses the stopwatch to record the time. Students will fly their plane three times and take the average of their times and distances to share with the class.

Trial	Time	Distance
1		
2		
3		

AVERAGE

## 2.4 Here comes the data!

The last task the students have to complete is putting all the information together. The students will make a large chart on the board of their average distance and time. Every student is required to copy the information, as they will need it for their data analysis. The students will again visit the computer lab where they will enter all of their data into a spreadsheet. Since I want the students to be able to perform the calculations, I have them calculate the rate by hand and not by using a formula in MS Excel. Students will then use the graphing feature of Excel to create a bar graph (or histogram), circle graph, and line graph. Students will then have to decide which graph best suits their needs. Students will also use their data to convert distances and create a frequency table, stem-and-leaf plot, and box and whisker graph. I give the students the following hand out for them to check off as they complete their work.

## 2.5 Handout

### “Flying High”

What you need included in your portfolio

1. Using the formula  $d = rt$ , calculate the rate at which the planes flew for ALL groups. (answers should be in cm/s) 20 pts.
2. Table Should have the following values: group names with distance, time, and rate (calculated). Table should be NEAT and EASY TO READ. 10 pts.
3. Find the mean, median, mode, and range of ALL table values and individual columns (there should be four sets of data). 20 pts.

4. Convert distances from centimeters to meters, centimeters to millimeters, centimeters to feet, and feet to inches (use decimals rounded to two places). 20 pts.
5. Create a frequency table, stem-and-leaf plot, and box and whisker graph for the distance data. 15 pts.
6. Print out spreadsheet and bar graph (or histogram) of all three data columns. 15 pts.

Staple this sheet to the front and turn in.

## 2.6 Teacher Notes

I give my students restrictions on the material they can use to make their paper airplanes. The restrictions I give are that they must start out with a standard 8.5 X 11 piece of notebook or computer paper. No cardstock or other paper products. They may trim their paper to make it smaller, but may not use any paper larger than 8.5 X 11. These guidelines can be altered as seen fit.

This activity usually takes between 3-5 days. The length of the project depends on how much time is available in the class period.

I usually pair my students up for this project. If there is an unusually small class then the project can be completed on an individual level. There should be at least 10 groups to get a decent size set of data, but more than 15 becomes cumbersome for the students when completing calculations.

Something else I do is display the plane that flew the furthest in each class either on a bulletin board or by hanging it from the ceiling. The students love it when their work is displayed.

This activity can be done in grades 6-8 and with some creativity can be altered to add even more concepts such as scatterplots and non-linear functions.

## References

Alabama State Department of Education (2003). *Alabama Course of Study: Mathematics*. Author, Montgomery, AL.

NCTM (2000). *Principles and Standards for School Mathematics*. Author, Reston, VA.