



Sample Activity

from the Pre-AP workshop

Pre-AP[®]: Strategies in Mathematics and Science – Analyzing and Describing Data

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Pre-AP: Strategies in Mathematics and Science – Analyzing and Describing Data Sample Activity

Your teacher will provide a sheet of paper or card stock printed with a pattern you will use to make a model helicopter. Following instructions from your teacher, you and your classmates will each make one helicopter. Half of the class will make a helicopter with a long rotor; the others will make a short-rotor helicopter. Then you will perform an experiment and collect and analyze data to determine whether the two styles differ in flight time when dropped from the same height.

Before you begin dropping the helicopters and recording data, it is important to think carefully about the data collection process.

1. One way to compare the two helicopter models would be to collect data from one short-rotor helicopter and one long-rotor helicopter. One student could drop each helicopter one time and another student could use a stopwatch to time each drop. Suppose the long-rotor helicopter takes longer to land. Would you be confident in reporting that helicopters with long rotors take longer to fall than helicopters with short rotors? Why or why not?
2. Suggest a way that you could obtain better information if you were limited to only one helicopter of each type. Why might you still be concerned about conclusions based on the results of this experiment? Share your answers with your classmates. Note that when researchers design an experiment to answer a question or search for information, they use more than one *experimental unit* to avoid problems like the ones you and your classmates suggested.
3. In this experiment we are trying to compare the two helicopter types to determine whether they differ in drop time. Think of variables other than rotor length that might affect the time a helicopter takes to land. Discuss your ideas with a classmate and make a list of the variables you agree on.
4. If possible, we should attempt to *control* the variables you identified in exercise 3.
 - (a) Which of the variables can we control? Discuss with your classmate how this can be done.
 - (b) When there are variables that we cannot control, we hope that they will balance out across the two types of helicopters. Which variables did you identify in exercise 3 that you will not be able to control? Do you think that they will balance out as you collect your data? Explain why or why not.
5. Drops should be timed using a stopwatch. Discuss with your classmates how to get an accurate time for each drop.
6. One of the most important strategies in planning experiments is to incorporate *randomization*, or use of chance, wherever possible. For example, in this experiment it may be better not to drop all long-rotor helicopters and obtain data from them before you drop all the short-rotor helicopters. Think of problems that might result if you were to collect your

data this way. Then figure out a way to use chance to incorporate randomization of helicopter type in your design.

In class you and your classmates will share ideas about how to collect data. With your teacher's guidance, you will work together to decide on the details of your data collection plan. Be sure to decide how you will hold the helicopter before release. Take a few practice drops to see whether you find it easier to drop the helicopter when you hold it directly under the rotor or farther down the shaft.

Your teacher will select a location from which all helicopters will be dropped. Each student will drop a randomly selected helicopter from the designated location. Other students will use stopwatches to time the flights. As helicopters are dropped and times are measured, one student should record the data for long-rotor helicopters, and another student should record the data for short-rotor helicopters. Make sure that the name of the dropper is recorded for each drop. After all drops are completed, your teacher will copy the data and distribute a copy to each student.

The following exercises suggest ways to analyze the class data. Your goals are to summarize the results of your experiment graphically and numerically and to decide whether or not there is a difference in flight times for the two helicopter designs.

7. (a) Enter the data for short-rotor helicopters in a calculator or computer list and have the data sorted in ascending order. What is the minimum flight time for the short-rotor helicopters? What is the maximum time?

(b) Enter the data for long-rotor helicopters in a calculator or computer list and have the data sorted in ascending order. What is the minimum flight time for the long-rotor helicopters? What is the maximum time?

(c) Calculate and compare the ranges for each type of helicopter. Which type of helicopter seems to have more variability in flight time?

8. One way to compare two data sets is to make a histogram of each data set, using the same class intervals or bar widths for each histogram. Discuss with a classmate what class intervals you think would be good for these histograms. Then make both histograms on one sheet of paper, one directly above the other. Be sure to label axes well and to label the scales in the same way for each graph.