

DATA QUALITY

OBJECTIVES:

In this lab, you will learn methods by which to increase accuracy when making scientific measurements. You will learn how to represent data by means, standard deviation and standard error. These concepts will then be used to assess the quality of data reported in various forms of literature.

INTRODUCTION:

Scientific findings are often presented via news media sources to the general public. Scientists follow a rigorous process to generate data and draw conclusions from it. Scientists publish their data in many different sources of varying quality and reliability. Peer reviewed literature or journal articles that must pass the critique of multiple reviewers are of the highest quality and that which scientists strive most to achieve. Periodically scientists are also asked to write chapters in books that specialize in a topic. These frequently are only reviewed by the editors and are not generally considered of as high of a level of scientific rigor but are informative. Other types of reporting include “gray literature” (that which is generally published by special interest groups and is not peer reviewed) and news reports. Since the quality of data varies among sources, it is important to understand how scientific data are generated and reported in order to make your own judgment regarding the conclusions that can be drawn from any given set of data.

TREE MEASUREMENT

Question: What is the height of a tree?

This may seem a simple question to ask. However, a tree (depending on its size) may not be an easy thing to measure. It is not an object that we can easily bring into the laboratory and measure with sophisticated length measuring devices (especially if the forester wants it to grown some more!). Thus, we have to think of ways to measure the tree height *in situ*. Possible methods for measurement of tree height might include use of a ruler, a tape measure, a measuring pole or surrogate, a triangle.

PROCEDURE

You will use three methods to measure height of a tree. All students should measure the same tree. Work in groups of 2 and don't share information with other groups until all measurements have been made, else bias may occur and measurements can not be considered independent (which is one of the requirements for statistical analysis). Record measurements on the [Data Sheet](#).

1. Locate the tree that is recommended by your instructor.
2. First, guess what the height is and record your guess.
3. Second, make an educated guess by measuring the height of your partner with a tape measure and have him/her stand by the tree. Stand back and use your thumb extended at arm's length to figure out how many times your partner's height would have to be repeated to make up the height of the tree.
4. Third, use a slightly more sophisticated method, triangulation. Extend a measuring tape from the base of the tree. Hold a right isosceles triangle at arm's length and sight along the hypotenuse to the top of the tree. Keep the bottom of the triangle parallel to the ground. Back up (avoiding obstacles) until the tree top is in line with the hypotenuse. Use basic geometry to calculate the height of the tree. Remember to account for your height.
5. Pool the data and calculate the mean and standard error. Plot the data on graph paper.

ASSESSMENT OF DATA QUALITY PRESENTED IN LITERATURE

For this portion of the lab, work in groups of 4 (your lab group). Each person in a group will be given copies of the same article. Each group will have a different article. It is your job to read the article during a portion of the remainder of the class. Each group will then be responsible for presenting a brief summary of the information in the article to the class and for critiquing the data presented in it. Presentations should last 5 to 10 minutes and all lab group members should participate.

Things to keep in mind when presenting are:

1. Who is the author?
2. What do you know about this author and his/her previous work?
3. Who is the publisher?
4. What kind of publication is this?
5. How much information is presented about the data collection methods and statistical analyses?
6. How is the data presented? What do you think about the clarity of the presentation?
7. Is there enough information presented to allow you to develop your own conclusions? Do you agree with the author's conclusions?
8. What is missing?

Lab Questions

1. Which method for measurement of tree height was most accurate? How do you know?
2. What does the standard error tell you about the data that you don't know from observing the means?
3. Why did you need to know your height for the triangulation measurement?
4. Is the triangulation method a direct or indirect measure of the tree height?
5. What problems are associated with the three methods?

Data Sheet

Group	Guess	Educated Guess	Triangulation
Mean			
Standard Error			