

Lab 1: What is measurement?

One of the key parts of an experiment is measurement. We say that science experiments are reliable. Yet, each time we repeat an experiment it yields slightly different results (the difference can be very, very small at times) – then, **what does it mean to consider an experiment as “reliable”**, or to quote the result of a measurement? How do we deal with the variation in the results? We could stop at just one measurement – and avoid the whole problem of variation. But will that be the best solution? If not, what do we do with the numbers pouring out and when do we stop taking data? From the various results obtained, what can be tell about the reliability of our experiment? We will start exploring these issues in this lab via the activity of measuring a person's height.

Always follow any instructions provided by your TA.

MAJOR GOAL:

Explaining variation in the data that result with multiple trials and how that is related to reliability of the experimental data. What to do with the resulting data?

First Day Introduction: 10 min.

I. Brainstorm(Group) + Class Decision 5+5 min Groups of 4

What are different ways to measure a person's height? Think of methods that have different levels of precision. As a class decide on 3 distinct ways to measure someone's height.

II. Measurement and Documentation 30 min

Designate 1 student in the lab as subjects. Each person should measure the height of the designated students. Write the lab report as you work.

III. Representation of Data + Group Discussion 15 min Groups of 4

Use the graph sheets to represent the data from the three distinct ways of measuring the height. What would you say is the height of the persons? Which method of height measurement yielded the most reliable results and which the least? How can you tell? (This should also be in your report)

IV. Presentations + Class Discussion 30 min Whole Class

How did your group decide on which is the most reliable method?

Why were the numbers from repeated measurements different?

What's your best guess about the person's actual height?

How can we improve on the reliability of our estimate?

V. Evaluate your experiment 15 min Groups of 4

Use the remainder of your time to write the evaluation section.

What's your best guess about the person's actual height? Suppose the person's height is going to be measured by a million-dollar imaging machine whose results are EXTREMELY accurate. Would you bet \$50 that the imaging machine's result will exactly agree with your number? Why or why not? Would you bet \$50 that the imagine machine will agree with your value to within 0.5 mm? Why or why not? To within 1 mm? To within 2 mm? How many millimeters would it have to be before you'd be barely willing to make that bet?

How could you have made your experimental results more reliable – in other words, what could you have done to make that betting range in the previous question smaller?

Turn in your lab report.