Introduction to Data Collection

Data collection is a very important part of science. Meteorologists collect weather data over time to keep an historical record and to help make forecasts. Oceanographers collect data on the salinity of seawater to study changing trends in our Earth’s oceans. While data have been collected by hand for thousands of years, the technology to collect data electronically has been around for few that 80 years. Only in the last 20 years has this technology been available to schools.

This experiment was designed to introduce you to two of the most common modes of data collection that will be used in this class. Part I will guide you through collecting and analyzing data over time. A temperature probe will be used to record the temperature of water for 60 seconds at a rate of one sample per second. In Part II, you will collect data using a mode called Events with Entry. This style of data collection allows you to collect one point of data, then will ask you to enter a corresponding value. In this experiment, the data collected will be the temperature of your hand and the value you enter will be your assigned group number.

# Objectives

In this experiment, you will:

* Become familiar with LabQuest
* Use a LabQuest and a Temperature Probe to make measurements
* Analyze a graph of the data
* Use this graph to make conclusions about the experiment
* Determine the response time of a Temperature Probe

# Materials

* LabQuest
* LabQuest App
* Temperature Probe
* Cold tap water
* Hot tap water
* Ice
* Two 250 mL beakers

# Procedure

Part I Time Graph

1. Place about 100mL of tap water into a 250 mL beaker. Add two or three ice cubes
2. Connect the Temperature Probe to LabQuest and choose New from the File menu. If you have an older sensor that does not auto-ID, manually set up the sensor
3. On the Meter screen, tap Rate. Change the data-collection rate to 0.5 samples/second and the data-collection length to 60 seconds. Select OK
4. Place the Temperature Probe into the cold water and stir briefly. Then position the probe in the cold-water beaker. Note: Make sure the beaker will not tip over from the weight of the Temperature Probe.
5. Place about 150 mL of hot water into a second 250 mL beaker.

Note: in Step 7, you will switch the Temperature Probe from the cold water to the hot water at exactly 10 seconds after you have begun data collection. This will be done as the fifth data point appears on the screen

1. When everything is ready, start data collection. Do not stir or move the water.
2. When exactly 10 seconds have gone by, quickly move the Temp Probe to the beaker containing hot water and allow data collection to continue. Do not stir the water or move the Temp Probe during the remainder of the data collection period
3. Data collection will stop automatically after 60 seconds
4. Remove the Temp Probe from the beaker and dry it with a paper towel
5. Determine the elapsed time when the highest temperature was reached
   1. When data collection is complete, a graph of temperature vs. time is displayed. To examine the data pairs on the displayed graph, tap any data point. As you tap each data point, the temperature and time values are displayed to the right of the graph. Find the highest temperature.
   2. Record this temperature and the time when it was first reached in the data table
6. Sketch or print copies of the graph as directed by your TA
7. You can confirm the time when the highest temperature was reached by viewing the data lists directly
   1. Tap the table to view the data lists
   2. Find the time when the highest temperature was first reached. Did you get the same both ways?

# Part II Events with Entry

1. Tap the Meter tab
2. Set up the data-collection mode.
   1. On the Meter screen, tap Mode. Change the data-collection mode to Events with Entry
   2. Enter the Name (Member) and leave the Units field blank
   3. Select OK
3. Number the members of your group by age with the oldest being number one. Record the names in the data table. Add more lines if needed
4. Start data collection
5. Measure the hand temperature of the first group member
   1. Group member number one should pick up the Temp Probe and hold its tip in the palm of his/her hand
   2. Watch the live temperature readout. When the temperature stops rising, tap Keep
   3. You will be prompted to enter a number. Enter 1 as the student’s group member number, then select OK. The temperature and group member number have been saved.
6. Cool the Temp probe down by placing it in the cold water from Part I. Monitor the temperature on the screen and remove it from the water when the temperature reaches 25 degree Celsius
7. Pass the Temp probe to the second group member and repeat Step 17, entering 2 for the group member number.
8. Repeat Steps 17-19 until every group member has his/her hand temperature recorded.
9. Stop data collection
10. Determine each person’s hand temperature by using one of the methods described in Steps 10 and 12. Record the values in the data table
11. Sketch or print copies of the graph as directed by your TA

# Data

Part I Graph

|  |  |
| --- | --- |
| Maximum Temperature (in Celsius) | Elapsed Time (S) |
|  |  |

Part II Graph

|  |  |  |
| --- | --- | --- |
| Group Member Number | Group Member Name | Maximum Temperature ( in Celsius) |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| Group Average | |  |

# Processing the data

Part I Time Graph

1. Describe the appearance of your graph in Part I
2. Why is time plotted on the horizontal axis in this experiment?
3. Why is temperature plotted on the vertical axis?
4. Determine the Temperature Probe’s response time. To do this, use your data to find how long it took for the Temp Probe to reach the maximum temperature after moving it from the cold water to the hot water
5. Explain how you determined your answer to question 4

Part II Events with Entry

1. Calculate your group’s average for the maximum temperatures. Record the result in the data table.
2. Who had the hottest hand?
3. Who had the coldest hand?