

# Schoolground Study

In this lab, we will incorporate built-in GPS capability of the LabQuest 2 along with other sensors to do a survey of the school grounds. After uploading the data to Logger Pro in a computer, the data can be exported to Google Maps to see in some detail where the various data points were gathered and to interpret the results.

## OBJECTIVES

In this experiment, you will

- Measure ground and air temperatures at various locations.
- Measure reflected light intensity at various locations.
- Record the GPS coordinates of the locations as these measurements are taken.
- Determine if there are temperature differences between the ground and air above it.
- Organize and present your results.

## MATERIALS

LabQuest 2 or LabQuest 1 w/ VGPS  
LabQuest App  
Temperature Probe  
Light Sensor

Infrared Thermometer  
meter stick  
several rubber bands

## PROCEDURE

### Part I Planning Data Collection

1. Make a sketch of the school grounds including details such as different surfaces, trees, etc.
2. Plan the locations where you wish to collect your data and indicate them on your sketch.

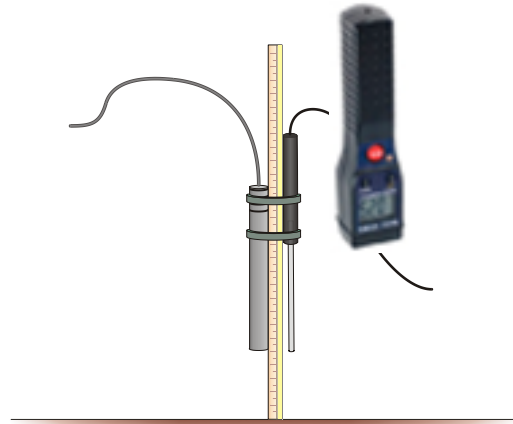
### Part II Measuring Temperatures and Reflected Light Intensity

3. Turn your LabQuest 2 on. Tap **File > New**. Set up the GPS sensor by tapping **Sensor > Sensor Setup**. Tap the box next to **GPS** to set up that sensor.
- 3a. For LabQuest 1, plugging in the Vernier GPS sensor initiates collection of GPS data. You don't have to set up like you do LabQuest 2.
4. If your Light Sensor has a switch, set it to 150,000 lux. Connect the Light Sensor, Temperature Probe and Infrared Thermometer to the analog inputs to your LabQuest 2. If you have older sensors that do not auto-ID, manually set up the sensors.
5. **Note:** If there is direct sunlight on the temperature probe tip during data collection, the readings will be too high. To prevent this, use your hand to shade the tip of the probe.
6. Fasten the Light Sensor to a meter stick using two rubber bands as shown in Figure 1 on the next page. Slide the Temperature Probe under the rubber bands on the other side of the ruler as shown in Figure 1. Both probe tips should be at the 5 cm mark.

**LabQuest**

7. Note that Data Collection has been set to **Selected Events**. After you begin data collection, each time you tap the **KEEP** icon, a set of data will be recorded for that location.

8. Move to the first location you planned to take measurements. Initiate data collection by tapping the Collect icon or pressing the Collect button. Position the meter stick so the temperature probe is shielded from the sun, the light sensor is pointed straight down, and the Infrared Thermometer is pointed straight down. Tap the **KEEP** icon to record your measurements. Do not stop data collection until you are finished with step 9.



*Figure 1*

9. Move to the next location, arrange your sensors, tap **KEEP**. Continue until you have collected data at all of the locations you planned. Then tap the Collect icon or button to stop data collection.

10. Go to the Data Table and record the data from six of your locations in the table below. Include descriptions of those locations from your sketch. The Infrared Thermometer reading is the surface temperature while the temperature probe recorded the 5-cm reading.

**DATA**

Description	Temperature (at surface) (°C)	Temperature (at 5 cm) (°C)	Temperature difference (°C)	Light intensity (lux)

## **PROCESSING THE DATA**

1. In the space provided in the data table, subtract to find the difference between the temperature on the surface and the temperature 5 cm above the surface at each location.
2. Which location had the greatest difference between its two temperatures? The smallest difference?
3. Give possible reasons for the results in Question 2.
4. Which location had the highest reflectivity? The lowest?
5. Give possible reasons for the results in Question 4.
6. Look at your reflectivity and temperature data. Do your results follow a pattern? Explain.
7. If you did this lab at a different time of day, would you expect similar results or differences? Explain.
8. If you did this lab at a different time of year, would you expect similar results or differences? Explain.
9. Connect your LabQuest 2 to a computer using the USB-mini cable. Launch Logger Pro software. Logger Pro should discover the LabQuest and its data and ask you if you wish to upload it. Your answers should be “Yes” and “OK”.
10. If the computer is connected to the Internet, you can export it to Google Maps. Go to **File > Export As > Google Map...** Zoom in or out as needed to display the data you collected. You may wish to go to Satellite View so you see the buildings as recorded by Google. Prepare a short presentation for your instructor, answering questions 2-6 above citing specific data from the Google map.

This lab was adapted by C. Bakken for use in an on-site workshop.

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