Motion (Distance & Displacement) Teacher's Guide

Subject: Integrated Science (Life; Earth-Space; Physical)

Topic: This field lab introduces students to the concepts of motion with specific reference to two ways of describing how something changes position: *distance* and *displacement*. In addition, the lab will introduce standard units of measurement for time and distance and address the formula for average speed.

Summary: Students will learn about distance, displacement, and average speed by walking to and from predetermined positions in the park using a measuring wheel and stopwatch. They will use this information from these tools together with a compass and calculator to determine their distance, displacement and average speed.

Objective(s): After completing the field lab, students will be able to:

1. Distinguish between distance and displacement
2. Use a measuring wheel, stopwatch, compass and calculator
3. Use the equation distance/time to determine average speed

Ecosystem(s): Karst Ecosystems

Equipment:

- Measuring Wheel
- Topo map
- Stopwatch
- Calculator
- Compass
- Ruler

Background:

- **Vocabulary**: distance, displacement, average speed, vector, direction, bearing, direction of travel, pace, step
- **Reference Material**: Glencoe 7th Grade Florida Science Science; What is Motion? (pgs 98-99); Website: http://www.physics.gatech.edu/academics/classes/2211/main/demos/displacement/DDis.html;
- **Equipment Training**: compass, map (optional)

Procedure (Engage; Explore; Explain)

1. Engage the students by asking a specific question that gets to the heart of the activity: If I walk 3 miles north, 3 miles east, 3 miles south, and 3 miles west, how far will I have moved from my original position? Use the students' answers to ascertain what they already know, clarify any misconceptions, and then ask them to formulate their own hypothesis relating to their own expectations of the outcome of the lab.
2. As a group students will discuss and assign roles. One student will use the measuring wheel, one will use the stopwatch one will use the calculator, one will use the map and ruler, and one will use the compass.
3. Starting at the [insert start location], students will begin timing and measuring distance by walking around [insert path].
4. Students should record their measurements of distance and time. Students will use the calculator to determine their average speed. They will use the map to determine their displacement (straight line distance with bearing). They will use the compass to get the bearing from the end point to the start point and then reverse it 180 degrees.
5. Students will repeat this process for the second segment, which will begin at the [insert start location] and end on the [insert end location].
6. Repeat measurements outlined in step number 4
7. After completing the lab, allow the students to answer the discussion questions as a group and explain their answers relating them to the concepts, processes and skills associated with the activity. Students should record their answers individually. At this time, facilitators can introduce/explain the specific concepts and explanations in a formal manner.

Sunshine State Standards:

Science: SC.H.1.3.1; SC.H.1.3.4; **Language Arts**: LA.C.1.3.1; **Mathematics**: MA.B.4.3.1; **Social Studies**: SS. B.2.3.9

Motion (Distance & Displacement) Student Data Sheet

General Information

Full Name:		Date:	
School (teacher):		Time:	

Student Hypothesis and Rationale

If I walk down a path that is paved then my average walking speed will be (circle one: faster or slower) than if a path is unpaved and irregular, because . . . _____

_____

Field Observations/Measurements/Data

Measurement	Trip 1 Paved and Level	Trip 2 Irregular Natural Trail
Start Location		
Finish Location		
Distance (in feet) *1 meter equals 3.28 feet*		
Number of Paces (optional)		
End Time or Total Time: (in seconds)		
Average Speed (distance / time)		
Direction or Compass bearing from starting point to end point (since this measurement will be taken in reverse use the opposite of the bearing shown on the compass)		
Displacement (use map and ruler to estimate the straight line distance between start point and end point, and include bearing)		

Motion (Distance & Displacement) Assessment Questions

1. What was the distance of Trip 1? What was the displacement of Trip 1?

2. What was the difference between the average speed for Trip 1 and the average speed for Trip 2?

3. Was your hypothesis supported by your data? If not, why?

4. How might your results have been different if the area was covered by three feet of snow?

5. On steep terrain a path that runs straight up a hill has a shorter distance than one that zig-zags or has switchbacks up the hill, but both have the same displacement. What is the advantage then of a trail that has switchbacks?

6. Think about what you learned in this lab; has it generated any new questions? Write a new question (related to the subject) about something you want to learn more about.

Motion (Distance & Displacement) Portfolio Journal Prompt

We often seek out the shortest path between two points. Occasionally we take the longer route and are pleasantly surprised by what we find. Describe a time when you took the less direct route going somewhere and why you were or were not happy with your decision. Before you begin writing, think about the difference between the terms destination and journey.

Motion

Reference Map

Displacement

Determine your 'displacement' by drawing a straight line from your starting point. Measure the distance along the scale at the bottom of the map. Note the general direction (compass bearing using the compass rose.

Trip 1:
Start:
End:

Distance:

Direction:

Trip 2:
Start:
End:

Distance:

Direction: