emcsquared: Another Walk on the Beach

Title:	**Grade:**	**BIG Idea:**
Another Walk On The Beach **Adapted from GPS Frameworks:** **Unit 2 - Patterns and Relationships** ***A Walk on the Beach* task** *Requires **Vernier Logger Lite Software and Go! Temperature Probe** (see more in *MATERIALS* section ; software is free; probe is very affordable)	**7th** **Author(s)**: Kay Daniels Linda Lenhard Laura Perryman Hope Phillips Sherry Simmons	Understanding Linear Relationships

Prior Knowledge Needed:

Students need to be able to:

- identify variables in a given situation
- identify independent & dependent variables and on which axis each is placed on a coordinate plane
- create a coordinate plane and number the x- and y-axes using equal increments
- plot points on a coordinate plane
- determine how a change in one variable affects another variable

GPS Standards:

M7A3. Students will understand relationships between two variables.

a. Plot points on a coordinate plane.
b. Represent, describe, and analyze relations from tables, graphs, and formulas.
c. Describe how change in one variable affects the other variable.

M7D1. Students will pose questions, collect data, represent and analyze the data and interpret results.

g. Analyze and draw conclusions about data, including describing the relationship between the data.

M7P1. Students will solve problems (using appropriate technology).

M7P5. Students will represent mathematics in multiple ways.

M7P3. Students will communicate mathematically.

Objectives:

1. Collect, organize, and graph data that relates to two variables.

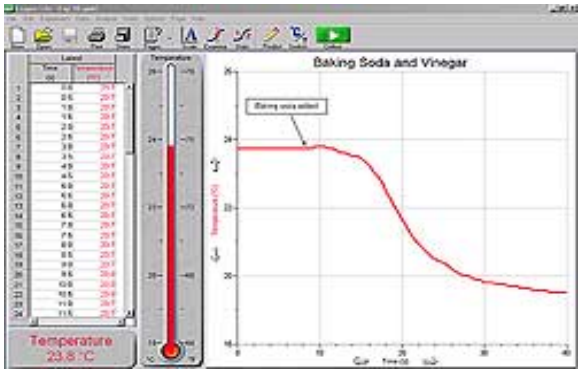
2. Analyze graphs and tables to determine the relationship between quantities.

Materials:

Technology Needs:

- Laptop Computer
- Digital Projector

- Vernier Probe & *Logger Lite* software: This data-collection software and temperature probe can be purchased at http://www.vernier.com/go/loggerlite.html They are easy to use and allow students to experience real-time data collection. The *Go! Temperature probe* takes temperature readings. Data are displayed on a table and graph like the one below:



Go! Temperature probe (price $39 as of Dec. 2010) *Logger Lite Software* is FREE with the purchase of the probe.

http://www.vernier.com/go/gotemp.html
Find the link on this page for a short demonstration of how to use the *Go! Temperature* probe.

See how Go!Temp makes affordable data-collection tools easy and fun!
Watch the Interactive Demo of Go!Temp (requires Flash plug-in).

Other Material Needs:
Plastic Container with Dry Sand
Plastic Container with Wet Sand
Container of room temperature water
Heat Lamp
Stand (or similar device) for holding heat lamp

Handouts:

Student worksheet- adapted from Unit 2; Patterns and Relationships; *Walk on the Beach*

Task:

Have you ever tried to walk on the beach when the sand was so hot that it burned your feet? Using dry sand, wet sand, and a heat lamp, simulate the sun heating the sand on the beach.

Description and Teacher Directions:

A paper-and-pencil task in its original form, this task has been re-written here as a simulation, using sand, a heat lamp, and Vernier software/probe.

Teacher Commentary:

Temperature of the classroom will affect the temperature of the sand. The data collection from my morning classes were more successful than

The teacher should develop a dialogue with students about their experiences visiting the beach. If students have never been to the beach, they can still participate in the conversation based on their predictions. Ask students to describe how the sand changes throughout the day. One approach could be to discuss how in the morning one can walk on dry sand without shoes but how this becomes more uncomfortable in the afternoon. This change in the sand is the effect of some underlying cause -- the sun heating the sand throughout the day.

Tell students they will be looking at how the temperature of sand changes over time. Ask them to decide -- Which variable is independent -- temperature or time? Why? Which variable is dependent? Why? (**Answer:** *time* - independent & *temperature* - dependent). Temperature is a function of (depends on) time. Time is not a function of (does not depend on) temperature.

Ask students to sketch the graph they think would represent the effects of the heat lamp as it warms the **dry** sand. Allow several students to display their predictive graphs for the class. At this point, the correctness of their graphs is *not* the focus of discussion. Focus, rather, on the relationship between the variables and the students' discussion of their graphs. It is possible that students' understanding of the relationship exceeds their ability to draw accurate graphs. This discrepancy will be addressed when the actual data is graphed and a discussion of its shape will follow.

To begin collecting data, do the following:

1. Set the *Logger Lite* software to take a temperature reading every fifteen (15) seconds for four (4) minutes.

2. Using the *Go! Temperature* probe, take the initial temperature of the dry sand before turning on the heat lamp. (*Note: You do not have to bury the probe deeply in the sand for the probe to work correctly.)

3. Turn on the heat lamp and immediately begin the data collection using the probe (i.e. Press the *Collect Data* button).

4. Based on the resulting data in the table and graph, answer the questions on the worksheet (see attachment in the MATERIALS section)

Repeat steps 1-4 above for wet sand. The sand should be damp, however, not so wet as to be sitting in excess water. The water should NOT be cool or cold. Room temperature is ideal.

Take care to insert the probe at approximately the same depth as you did in the dry sand. The same is true for the heat lamp's placement near the wet sand.

In the teacher commentary section of the original GPS Frameworks task, *A Walk on the Beach*, consider asking the *Questions to Access Knowledge* (p.25). They provide a more in-depth look at the mathematics behind the activity compared to the questions on the student pages.

my afternoon classes. I would have a second set of dry and wet sand. Sand in both samples, dry and wet, maintained a higher temperature after being heated.

It is recommended that you practice this task before presenting it to students. Negotiating the following require practice to maximize the success of the task: placing the heat lamp on the stand relative to the sand, inserting the probe into the sand, and using the software.

Resources:

***Learning Village*; GPS Framework task; Unit 2; see p. 20-27 for original task and teacher commentary**

http://www.learningvillage.gadoe.org/_catalogs/lvContentItems_13/DispForm.aspx?

ID=139&source=/_layouts/LearningVillage/CloseDialog.aspx

Similar lesson can be found on Texas Instruments website at
http://education.ti.com/calculators/downloads/US/Activities/Detail?ID=11617

Another Walk on Beach.doc This worksheet is based on the Unit 2 activity, *A Walk on the Beach*. See *Teacher Commentary*, p. 22-25, on *Learning Village* for answers.

Walk on the Beach Assessment Item.doc

Assessment Item Answers [Walk on the Beach].doc

A Walk on the Beach Assessment Items