STEM ACTIVITY Lesson Plan Template

Teacher: Kiersten Carter (Fifth Grade) Building: FMS
Course: Everyday Math
Unit: Project 8
Date: 2013-2014

STEM_ Standards_ (CCSS/NGSS)	Student Language	How Demonstrated (Assessment)	Real World Connection
5.OA.5 Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them.	I CAN: I can collect, display, and analyze data.	Formative assessment through student performance of activity.	Pendulums were integral to the development of clocks. Clocks, in turn, made possible the long-sought solution to measuring longitude. (Story of John Harrison who dedicated 40 years to design the perfect sea clock: precise clocks designed so a ship's motion and variations in temp. and humidity did not affect the clocks' pendulums.

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Lesson:

I. **Background Information: See Real World Connection (above)**

Introduce the project by discussing the question posed in the Real World Connection box. Students will continue to work together for the duration of the project.

II. **Technology/Engineering Standards: See Standards (above)**

A) Collect and organize data to create a line graph.

B) Predict the outcomes of experiments, test the predictions using manipulatives, and summarize the results.

III. **Critical Key Vocabulary Term:**

Pendulum: A pendulum consists of an object, called the bob, suspended from a fixed support in such a way that the object can swing freely back and forth under the influence of gravity.

Complete swing: In a complete swing, the pendulum swings forward, stops for an instant, swings back (almost) to its starting position, and stops for an instant.

IV. **State the Challenge/Problem:**

a. **Does the time it takes a pendulum to make a complete swing depend on the length of the string?**

b. Criteria and constraints: A formed pendulum that is 50 cm long. Ten complete swings must be done to obtain an accurate time measurement for a single swing. Point out that timing a single, complete swing can be tricky, and the chance of error is great.

V. **Materials Per Group:** string pendulum, ruler or meter stick, wrist watch or clock to time seconds (preferable to tenths of a second), ten metal washers or similar weights, and graph

VI. **Procedure:**

1. Ask a student to keep time with a seconds timer.
2. Pull the pendulum to one side. As you release it, say, GO! The student starts timing.
3. With the class, count out ten complete swings (not half swings).
4. When the pendulum finishes its tenth complete swing, say, STOP! The student stops timing.
5. The student gives the elapsed time (to the nearest tenth of a second, if possible).
6. Record results in the graph.

VII. **Design Process Steps:**

1. Prepare one string pendulum for each small group.
2. Cut as many 1 ½ m strings as there are groups.
3. Tie a paper clip to one end of each string.
4. Use a marker to mark each string 5 cm, 10 cm, 20 cm, 30 cm, 50 cm, 75 cm, and 1 m from the end of the paper clip.
5. Open up the clip so large metal washers or similar weights can be hung on it.

6. Prepare one additional pendulum with a string at least 2 m long and a paper clip at one end for demonstration purposes. Mark the string 50 cm, 75 cm, and 2 m from the clip.

VIII. Extension(s)

Obtain a copy of "Longitude" by Dava Sobel (Walker, 2005) and/or "Sea Clocks: The Story of Longitude" by Louise Bordon (Margaret K. McElderry, 2004).

IX. Scaling the Lesson Up and/or Down

Suggest students make long pendulums that they can safely swing from high places, time the swings, and report the results to the class. Have students prepare a larger graph incorporating the results.

S.T.E.M. Connections include:

Science- Motion
Technology- Design process, Modeling complete swing
Engineering- Problem solving, Technological design of complete swing
Math- Elapsed time measurement, Graphing

REFLECTIONS: