Plant the Daisy

Brief Description:
The larger "daisy" in this exhibit is attached to a 10-foot tall pole. The participant will try to place this pole over a small post sticking up from the center of a weighted pot. The task seems easy at first, but the pole is surprisingly difficult to control when held in one hand at the nodal point. Small children can use the miniature version.

Objectives:
Students will learn about the different parts of a wave in a very unique way at this challenging exhibit. Plant the Daisy provides a great jumping-off point to connect math to real world situations, such as how musical instruments work and the types of problems architects may encounter when building structures.

Links to Websites:
http://en.wikipedia.org/wiki/Normal_mode

http://mathmidway.org/Training/daisy.php

http://hyperphysics.phy-astr.gsu.edu/hbase/Sound/stawav.html

http://videos.howstuffworks.com/tic/29833-understanding-tacoma-narrows-bridge-video.htm

Vocabulary:
Amplitude
Antinode
Dampening
Frequency
Fundamental node
Harmonic node
Node
Normal mode
Oscillating system
Phase
Sinusoid
Standing wave
vibration wave theory

Before:
- *(Level 3)* A vibrating object (such as a guitar string) has different modes of vibration. These different modes are different ways in which the vibration happens. The fundamental mode of vibration occurs when the most vibration happens in the middle of the object and the ends don't move at all.

  You can demonstrate this with a slinky in your classroom. It's easiest to do if you wave the slinky along the floor and have students around it. Stretch the slinky along the floor. A student at one end will hold the slinky still. The student at the other end starts waving the slinky until the fundamental mode is achieved. This pattern will show the largest amount of movement (an antinode) in the center of the slinky, and the ends are nodes, where the amount of movement is smallest.

  Once you've established the fundamental mode of slinky vibration, the student who is waving the slinky can begin waving faster to achieve the 2nd mode of vibration. He or she will have to wave the slinky twice as fast to achieve this mode. When the 2nd mode is

achieved, you will be able to see a node in the center of the slinky and antinodes between the center and the students. Continue waving faster and faster to see how many nodes and antinodes you can achieve.

See a video of how standing waves look with Slinkys:
http://hyperphysics.phy-astr.gsu.edu/hbase/Sound/stawav.html

During:

- (*Level 1, 2, 3*) Hold the daisy at a variety of places along the stem. Observe the amount of wiggle in the stem.

- (*Level 3*) Try to plant the daisy! See if you can estimate the frequency of the wave by counting the wobbles.

After:

- (*Level 3*) Watch a video of the Tacoma Narrows bridge to see the effect of vibration on architectural structures. http://videos.howstuffworks.com/tic/29833-understanding-tacoma-narrows-bridge-video.htm