Spaghetti Bridge Lab

Students find a relationship between the number of spaghetti strands making a "bridge" and the largest number of masses that can be supported. This activity provides a great environment for discussing independent, dependent and control of variables. Students should also graph their data and write an equation for the graph. Finally, students should provide interpretations of the physical meaning of the slope and y-intercept.

Top View

Materials:

- Uncooked long-strand spaghetti, thick and thin
- Disposable plastic cups
- String
- Unit masses: Marbles, washers, or nuts

Pre-Lab Discussion:

Show the students the experimental setup and ask them what they could measure about the bridge. Record all of the student suggestions on the board. Most of the items they suggest will fall into two categories: bridge design factors and measures of bridge strength. Students can choose the design factors, therefore those factors are the independent variables. Suggest that the bridge design factor of interest is the number of spaghetti strands. The design of the bridge will determine how many marbles can be supported, therefore the number of marbles is the dependent variable. Ask the students to measure and record the value for all of the other variables on the board, which must be held constant, or controlled.

Lab Procedure Notes:

[] Don't get the tables too far apart!
[] Have each group increase the number of marbles until the bridge breaks. They should record the last number of marbles actually supported.
[] Have each group assign a "catcher" for the cup, otherwise there will be potentially dangerous marbles scattered all over the floor.

Side View

Data Analysis:

Students should graph their data, (which will be pretty linear) draw a best-fit line, and determine the slope and y-intercept of their line. Students should be asked to write an equation for their graph. You may need to remind them of the general form of the equation for a line, $y = mx + b$.

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Example equation:
(bridge strength) = 0.7 marbles/strand * (bridge design) + 0.5 marbles

Post Lab Discussion:
Have the students draw their graph, equation, and variables they held constant on large whiteboards. Have the class stand in a circle so that they can all see each other's boards. Direct the discussion using questions to specific individuals and feel free to repeat important questions.

Example questions:

Ask students about their experimental procedure: What was your independent variable? What was your dependent variable? What is meant by control of variables? How did you control variables? Why did you control variables? How is a dependent variable different from an in dependent variable? How did you know you had collected enough data? What is the advantage of doing multiple trials?

Ask students about their graph and equation: Explain why you graphed this variable on the y and that variable on the x. What does the straight-line graph tell you about the bridge? What does the y-intercept mean in terms of your bridge? How do you determine the units of the slope? What does the slope of your graph tell you about your bridge? Why do different groups have different values for their slopes? What would a line with a larger slope look like if it were added to your board? What parts of the equation should have units and what parts of the equation do not have units?

You could conclude by explaining your lab report requirements and assigning students to write up the lab.