

Breaking Strength of Spaghetti Bridges

Guided Group Discussion (Approximately 20 minutes)

How is the length of a bridge related to the strength of the bridge? To address this question we build spaghetti bridges and measure the strength of each bridge by the number of pennies required to break the spaghetti.

Goals of discussion:

- Identify issues, variables, and parameters.
- Identify possible representations and preconceptions of the problem.
- Refine the problem.

Questions to Address in groups:

- What physical principles affect the relationship?
- What other factors or variables might come into play?
- How can we represent these relationships? (Discuss not only the *type* of representation, but also the qualitative properties of the relationship.)

Collecting Data (20 Minutes)

Length	Breaking Weight
2.0''	
2.5''	
3.0''	
3.5''	
4.0''	
4.5''	
5.0''	

Plotting Data (20 Minutes)

- Plot the data on graph paper (W vs L) and sketch a line that fits this data. Estimate the slope & intercept of line and interpret these values.
- Transform the data. Instead of graphing W vs. L, graph W vs. a function of L; e.g. L^n . Preconceptions often suggest a useful function to try. Fit a straight line to the result; interpret its slope and intercept.
- Make predictions from these lines of the number of pennies required to break strands of lengths 6'', 4.75'', 2.25'', and 1''.
- Compare reliability, or confidence in predictive power, for the two lines.

Sample Data on Spaghetti Bridges

<i>Bridge Length</i>	<i>Breaking Value</i>	<i>Model</i>	<i>Error</i>
L	B	L x B	B = K / L
(in)	(pennies)		
2.0	24	48.0	20
2.5	20	50.0	16
3.0	13	39.0	13
3.5	11	38.5	11
4.0	10	40.0	10
4.5	9	40.5	9
5.0	8	40.0	8

Best Guess for K: 40

Sum of errors : 8.8

