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Grade Level/Subject: Algebra

Topic: Scatter Plot graphs, Best Fit Lines, Linear Equations

Objectives (P.A.S.S.): Standard 2.2, 2.3, (Algebra I) Standard 2.1.a, 2.1.c, 2.1.d, 2.3, 2.4.a, 2.4.e, 2.5.b, (Algebra II) Standard 3.1

Introduction: This lesson graphically demonstrates a linear scatter plot graph and helps students to find the line of best fit for the data. It helps to understand what a linear graph means, helps to define slope as rate of change, and puts together the concept of what slope and the y-intercept mean in a linear equation. Students also find and write the equation of a line.

Instructional process: Have the students get in groups of two. Distribute the student handout which includes the instructions for the project, the data table, the graph, the extension questions, and the calculator extension problems. Give students the materials they need to complete the project. Be sure to discuss the procedure and to specify what they can and cannot do while conducting the experiment.

Closure: In closure, discuss the extension questions in detail and go over the concept of slope and y-intercept thoroughly, discussing what they mean in the problem. Then show the students how to complete the table and graph on the calculator and discuss the calculator graph in comparison to the student graphs. Show how to find the linear regression line on the calculator and compare it with the students equation of the line.

Assessment: The assessment for this project can be additional questions that use the results of the graph and linear equation to find additional information. For example, you can ask students how many pennies 10 strands of spaghetti would hold. Or how many strands would it take to hold 200 pennies.

Modifications/Accommodations: Be sure slower students are paired with stronger students but that each person in the group is working the extension problems on their own.

Reflection: Upon reflection, I would use thinner spaghetti strands so that more data could be collected. I might also have students place their table or chair different lengths apart (each group different) so that they can compare what different lengths do to the data.

## **SOME SPAGHETTI WITH YOUR ALGEBRA!!**

This experiment illustrates linear behavior using stat plots and lines of best fit (Linear Regression)

Each group will need:

- Two chairs (or using the ends of two tables)
- Several strands of uncooked spaghetti
- A plastic cup with small holes in the sides so that a string can be run through it so that the cup can be suspended by the string
- A lot of pennies ( at least 150 for each group) ... marbles can be used instead of pennies
- Data and Graph Sheet, Discussion and Question Sheet, Calculator, and Calculator information sheet.

What to do:

- Place chairs or tables 5 inches apart facing each other
- Place 1 spaghetti strand through the string loop and gently place the spaghetti piece between the chairs or tables.
- Gently load the pennies or marbles into the container until the spaghetti breaks.
- Record the number of pennies or marbles the strand could hold.
- Repeat the experiment with two strands, etc. until the table is complete.

## Spaghetti Problems

1. Describe the graphs, and compare your group's graphs with the graph of the other groups.
2. Use a piece of spaghetti to approximate the line of best fit.
3. What is the slope of the line?
4. What does the slope mean in terms of the experiment?
5. What do you think the y-intercept of the line should be?
6. What is the y-intercept of the line?
7. What does the y-intercept mean in terms of the experiment?
8. How would the change in the distance of the table or chairs affect the results of the experiment?

### Calculator Work:

Put your coordinates on the calculator and find the best fit line or line of regression.

Compare it with the equation you found for your best fit line.

Write down the equation from the calculator that you found as the line of regression.

Using that graph and equation find out how many pennies or marbles could be held with

- (a) 10 strands of spaghetti
- (b) 15 strands of spaghetti

Using the same information, find out how many strands it would take to hold

- (a) 200 pennies or marbles
- (b) 500 pennies or marbles

Explain the y-intercept that was found in the line of regression. Why is it what it is? What outside factors make it that number?

### Calculator Steps (TI-83 or TI-84 plus)

|                                 |                               |
|---------------------------------|-------------------------------|
| To enter lists                  | Stat-Edit                     |
| To create graph                 | Stat Plot On, ZoomStat, Graph |
| To Calculate Line of Regression | Stat - Calc-Linreg (ax+b)     |
| To Graph line                   | Y=                            |

Note: Be sure to clear previous lists and graphs from the calculator before using the calculator.

## SPAGHETTI DATA AND GRAPH SHEET

| #Spaghetti Strands | # of Marbles |
|--------------------|--------------|
|                    |              |
|                    |              |
|                    |              |
|                    |              |
|                    |              |

Use the data in the table to create graph. First, though, decide on a vertical scale based on the range of values and a horizontal scale based on the domain of values. Decide what the rate of change is for the data. Label the scales on your graph.

