NGCSU Lesson Plan

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Standards

State-Based Standards:

From GPS:
Topic: Data Analysis and Probability
MM2D1: Using sample data, students will make informal inferences about population means and standard deviations.
MM2D2: Students will determine an algebraic model.

Topic: Process Standards
MM2P1: Students will solve problems (using appropriate technology).
MM2P3: Students will communicate mathematically.
MM2P4: Students will make connections among mathematical ideas and to other disciplines.

From NCTM standards:
Data Analysis & Probability 9-12

- display and discuss bivariate data where at least one variable is categorical.
- recognize how linear transformations of univariate data affect shape, center, and spread.
- for bivariate measurement data, be able to display a scatterplot, describe its shape, and determine regression coefficients, regression equations, and correlation coefficients using technological tools

Lesson Plan

Unit/Lesson Topic:

Topic Name: Pearson's correlation coefficient
Grade Level: Math 2
Content Area: Mathematics
Type of Lesson: Application

Understandings:

Students will understand that just because a regression tool can generate a regression line doesn't mean that the data actually has the pictured relationship.

There are math procedures available to determine how well the data fits the regression line.

Essential Questions:

Does the generation of a regression line tell us everything we need to know?

Does a high r-value necessarily mean that the data are generally linear?

Does an r-value close to zero always mean that the data are not linear?

Knowledge/Skills: Students will . . .
learn about Pearson's correlation coefficient: the measure of the linear association between the horizontal variable and the vertical variable

Students will be able to . . .
- state if a regression line is a good fit by interpreting the Pearson correlation coefficient calculated for a specific regression line

Assessment Evidence: Performance Tasks

- students will perform lab tasks and I will observe for proper performance
- students will enter their collected data into a regression tool, printout the results, and provide a written analysis based on the scatterplot, the regression line, and the r-value; students will be measured on if they have made an accurate analysis, correctly backed up by the results

Learning Plan:

Time Alloted	Teaching and Learning Strategies
	From: "Correlation and the Regression Line: Lesson 3 of 4" http://illuminations.nctm.org/index_d.aspx?id=456
5 min	An important question that comes up in determining a curve to fit our data points is: How scattered can the points be and still have a shape that can be represented by a curve? The idea of correlation helps to measure this. When you click "Show Line" in the interactive applet, the value r, which appears in the top left section of the applet, is Pearson's correlation coefficient. It is a measure of the linear association between the horizontal variable and the vertical variable. It gives information about how tightly packed the data points are about the regression line. It thereby also gives information about how well the regression line fits the data. The r-values can range from -1 (strong negative linear association) to 0 (no linear association) to +1 (strong positive linear association). [use classroom whiteboard to draw graphs demonstrating tightly packed, negative linear, and positive linear] But beware! You will see below that the correlation coefficient, r, is sometimes misleading. You should always look at the scatterplot and combine that knowledge with the r-value in order to draw valid conclusions about the strength of the linear association.
20 min	Students will be asked to keep their hands off the computers, and follow along with the teacher on the projector screen to begin with 1. Compare the r-values for the following three situations.

• let's create a scatterplot that you think shows a strong positive linear association between the two variables. What is the r-value
• let's create a scatterplot that you think shows a strong negative linear association between the two variables. What is the r-value
• let's create a scatterplot that you think shows no linear association between the two variables. What is the r-value?

Now students will be asked to create these scatterplots on their own computers, while I walk around to see their results.
2. For each r-value below, create a scatterplot that has that exact r-value.
• r = 1
• r = -1
• r =0

3. Plot several points that exhibit a strong positive linear trend, and then plot one outlier.
• Overall, is this scatterplot roughly linear?
• Is the r-value close to 1?

4. In the lower left corner of the coordinate plane, plot 10 points that exhibit no trend (this is sometimes called a "cloud" of points). Then plot one point in the upper right corner.
• Overall, is this scatterplot linear?
• Is the r-value close to 1?

5. Does a high r-value necessarily mean that the data are generally linear? Does an r-value close to zero always mean that the data are not linear?

The moral is that the correlation coefficient, r, is a valuable tool for studying the linear association between two variables, but it does not fully explain the association (in fact, no statistic does).

30 min Students will take out their data sheets from the previous lesson's work on fish counting and data collection, and will switch to a regression tool that allows direct data entry (the tool used in this lesson so far is a little difficult to use when trying to enter specific data points).

They should enter their data from the fish counts (all students will have the same data) and from which data collection group they were in, i.e. pH level, oxygen content, silt content, and generate a regression line.

Print the page with the regression line and other information, including the r-value.

Have students volunteer to tell the class what type of relationship their data represented (positive, negative, no correlation) and how good of a relationship it is. Ask if they feel if the relationship leads to any conculsions.

After some general discussion, students should write up their conclusions in their own words using blank space on the graph printout or a separate sheet of paper to be turned in.

5 min Wrap-up

Summarize the concepts of regression lines and using the Pearson correlation coefficient to determine how well the data fits the regression line.

Lesson Modifications: This section should include how you will modify the lesson to meet individual student needs.

Resources

Resources:

1) computer lab (separate lab, or mobile laptop lab set up in classroom) with one computer for each student; each computer should have a connection to the Internet, or connection to a local server where the "regression tool" applets have been set up

2) computer and projector for use by teacher

Lesson Reflection

Analysis of Lesson:

Use this area to reflect on:

- What worked or didn't work
- Why it worked or didn't work
- Which students learned or didn't learn
- Why did they learn or not learn
- What assessment data lead to your conclusions
- If I were to teach this lesson again, what would I do differently