Predicting Future Trends in Great Lakes Shipping Using Multiple Representations of Data

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Target Grade: 7/8th Algebra

Lesson Overview: The students will work in groups using multiple representations (tables, graphs, equations, etc.) to predict trends in shipping. They will also be asked to make educated guesses about what the past has shown and what things might impact the shipping industry future in light of their analysis of the data.

Sources Consulted:
http://www.lcaships.com/CHARTF.HTM

Learning Objectives: The students will be able to use information about the changes in shipping in our area to create a variety of representations of the data. These representations will then be interpreted and the students will be using inferences to predict shipping tonnages both short and long term. Emphasis will be placed on using the data to support their claims.

State or National Benchmarks Addressed:
State: A.PA.07.01, A.PA.07.03, A.PA.07.04, A.PA.07.05, A.PA.07.06

Common Core:

- 8.F.1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.[1]
- 8.F.2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.
- 8.F.3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.

Use functions to model relationships between quantities.

- 8.F.4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
- 8.F.5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

List Materials Needed:

Great Lakes Dry-Bulk Commerce: 2005-2010 available at http://www.lcaships.com/CHARTF.HTM one per group.
Chart paper (one per group) -- Self-stick work well for display.
Markers
Graph paper and/or graphing calculators
Straight edge/metric rulers
Scrap paper

New Vocabulary N/A: This is a lesson to cement and draw together Multiple Representations and their practical use therefore it is a new application and not new vocabulary.

Focus Question: Pretend that you are making a presentation to the board of a famous rich investor in our area. You have been asked to explain the future of Great Lakes Maritime Shipping so that they can decide if investing makes sense. In other words, **"Is there a future in maritime shipping?" You must answer about the next year and looking to the future "2020."** You may use all data given but think about the applications of the raw materials. Do you anticipate differences in their demand? How has the recession in 2009 impacted the shipping of each and what might that say for the future.

Classroom or Field Activities:

Step 1: Distribute the materials and ask students to look at the Great Lakes Dry-Bulk Commerce chart and think about what trends they see in the data.

Step 2: Ask the students to use the chart paper to create a visual aid for the "board meeting" that will help them explain their prediction for the next year and year 2020. Remind the students that they will be asked to support their choice and that it will be evaluated on whether or not it was a sound choice for the model of the situation.

Step 3: Allow the students to work on the data. Walk around encouraging them to use appropriate means. For instance, a bar graph is good for data that all numbers are known and compared only to each other for a set time; however, a line graph would be a better prediction tool into the future by using a graph to derive an equation of a scatter plot or other means. Emphasis should be placed of allowing discovery. The common core is quite clear that a deep understanding of how numbers relate in multiple representations is far superior to a feeling that math has but one right approach.

Step 4: When they have created their graphs they will be presenting to each other. They are to show their visual aid and answer the following questions:

1. Justify your graph type. Why does it suit the data?
2. What is your prediction for the year the next year? 2020? You must accompany the predictions with sound mathematical justifications in the form of graphs and derived equations.
3. Looking at growth and decay in the past make some inferences based on your prior knowledge that might explain any variation in the mathematical prediction.
4. Would you recommend the company invests in Maritime Shipping and why?

Assessment: See attached rubric. It is important to emphasize at this point that it should be expected and encouraged that each team will choose a different path to the prediction. For instance, some may start with a scatter plot and then use a line of best fit while others may find averages and then derive an equation.