Using Cartograms *Handout*

Students model lake volume ratios by building lake cartograms.

INSTRUCTIONS: Data can be represented in a three-dimensional visual scale model. In this exercise you will choose three lakes and make a cartogram comparing the volumes of the lakes.

Part One: Print three contour maps on transparency film.

1. First visit www.Seminole.WaterAtlas.org. Click Atlas and select the drop down arrow for Lake Name. Select a lake. When the General Info page shows an aerial of the lake, scroll down and click on Contour Map. If there is a contour map, make note of the lake and try several others. Select three lakes. Be sure the scales and contour line increments are the same for all three lakes. Revisit the lakes and record the name and dimensional data for each lake; surface area, volume, and contour key so you can construct your cartograms later.
2. Print each lake on transparency film.

Part Two: The Task

You now have three contour map transparencies and data that compare the surface area and volume of each lake. The assignment is to create three-dimensional topographic maps of the lakes that are in scale individually and with relation to one another by volume.

This is how a cartogram works: Scale models are compared by setting the scale of one model as a basis for the others. An example would be using Styrofoam balls to make a cartogram of three planets in our solar system. Earth could be scaled to one billionth its size and then the Earth's actual mass could be compared with the masses of Mars and Mercury. Rather than using size (volume) to scale Mars and Mercury to Earth one would use the relative masses of Mars and Mercury to Earth. You could use a computer search to find examples of cartograms.

Fortunately for this project the contour maps are already drawn to scale and so the first part of the assignment is easy.

1. Set up the transparency of the largest lake (by volume) on the overhead projector and position the overhead so that the lake will fit comfortably on 1/3 of a piece of poster board. Have the team copy the contour map (all lines!) onto a piece of poster board. Be sure to copy the map on the poster board in such a way as to leave room for two smaller maps next to the first and a base upon which to mount all three.
2. Record the elevation of the shoreline and the volume of the lake inside the shoreline on the part of the poster paper that will not be cut away. (Website > Atlas > Lake Name, scroll down to see volume in gallons.)
3. Count the contour levels in the lake. Decide on a pleasing progression of colors to use and gather the construction paper.
4. Cut out around the shore.
5. Write the depth on the inside of each contour line (on the smaller piece) in several places. If the contours are complex, draw two or three short lines in patterns across the contours. When cut apart, the lines can be rejoined to insure accuracy.
6. Cut on each of the contour lines. Carefully cut with an Exacto knife, or make the first cut with the Exacto knife and cut the rest of the line with scissors.

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7. To construct the first map, you will invert the depth rings to make the lake appear more like a hill. This hill will represent the volume of the lake. Rather as if the lake was frozen, and you plucked it up like an ice cube, and set it down with the lake surface on the bottom.
8. Start with the largest piece and cover each level with colored construction paper: Trace the outline of the piece on the color of construction paper you chose for the base (lake shore) which will be the bottom of the "hill." Transfer contour depths and other markings to corresponding places on the construction paper. Cut it out and neatly glue it onto the largest ring. Trim edges if needed. The ring will now resemble a flat plate with the elevation of the lake written all around the edge and the lake name and volume noted.
9. Repeat 7 with each ring, using different colors for each. Plan the colors to have a pleasing progression from low to high. Think of contour maps you have seen.
10. To assemble, lay the largest piece on the table. Position the second largest piece, the next contour ring, on top of the first. Use the markings you made and the map of the lake to help position the ring.
11. Stick columns of clay between the layers to give it some depth (height.)To make the columns, roll "snakes" out of clay. Use a ruler and plastic knife to cut appropriate pieces, all the same length, for the model. Or, cut disks of Styrofoam.
12. Repeat this procedure until the innermost (deepest, but now highest) part of the lake is complete and set in place. You have made a model of the inside of the lake, or the volume. The base of the model is the area of the top of the lake.

Part Three: Find the ratio of the lakes' volumes.

Now computation must begin. The first model is the largest lake by volume. It is the standard to which the other lakes must be scaled.

1. So we begin by forming a ratio between the volumes of the largest lake (L_A) and the next largest lake (L_B). This is accomplished by L_B / L_A = the scale of lake B. If your ratio came out to 1/4 then Lake B should be set to one fourth the scale of Lake A. Measurements of the first model will be necessary to set up the second model to scale.
2. Use the overhead projector and rulers or meter sticks to set the surface area to scale. Move the projector back and forth until the ratio of measurements are correct.
3. When the second model is finished then Lake C can be compared to Lake A for scale and the third model can be built.
4. Mount all three models on a poster board base. Label the models and write a paragraph explaining the models.

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