Mapping Data 1: Constructing a Choropleth Map

OVERVIEW & OBJECTIVES	GRADES
Students will become acquainted with mapping data and understanding the importance of recognizing patterns by constructing a choropleth map, which is a type of thematic map. Students become cartographers in this introductory lesson as they learn how to map data. Students will generate hypotheses based on the patterns and seek additional data to test the hypotheses. The lesson assumes data on U.S. states, but data at a local, national, or global scale may be used. *Students will be able to...* • Acquire skills in data based mapping • Recognize patterns of distribution • Analyze patterns of distribution • Construct and evaluate hypotheses of those distributions • Explain the concept of region	4th, 8th and 9th **TIME** 1 class **REQUIRED MATERIALS** ✓ Blank maps of United States ✓ Colored pencils ✓ Atlases ✓ Lists of data (from U.S. Census Bureau, CIA World Factbook, Population Reference Bureau, others) ✓ Handout: "Choropleth Maps" ✓ Computer access for students (optional)

MINNESOTA SOCIAL STUDIES STANDARDS & BENCHMARKS

(4th Grade)
Standard 1. People use geographic representations and geospatial technologies to acquire, process and report information within a spatial context.
4.3.1.1.1 Create and use various kinds of maps, including overlaying thematic maps, of places in the United States, and also Canada or Mexico; incorporate the "TODALS" map basics, as well as points, lines and colored areas to display spatial information.

(8th Grade)
Standard 1. People use geographic representations and geospatial technologies to acquire, process and report information within a spatial context.
8.3.1.1.2 Create and use various kinds of maps, including overlaying thematic maps, of places in the world; incorporate the 'TODALSS" map basics, as well as points, lines and colored areas to display spatial information

(9th Grade)
Standard 1. People use geographic representations and geospatial technologies to acquire, process and report information within a spatial context.
9.3.1.1.1 Create tables, graphs, charts, diagrams and various kinds of maps including symbol, dot and choropleth maps to depict the geographic implications of current world events or to solve geographic problems.

SUGGESTED PROCEDURE

Preparation:
The teacher will gather data and appropriate blank maps. (Note: Consider the following categories found at the U.S. Census Bureau to identify specific topics: Population, Income, Births and Deaths, Labor Force,

Education, Law Enforcement, Health and Nutrition, Elections, Agriculture.) Select data that may, as well as may not, indicate possible correlations with other data. States could be analyzed at the county or metropolitan level as well. Global data might include Infant Mortality Rate, Number of Physicians, and Number of Primary Schools.

Opening:
Begin by showing students a list of data and discuss what the data seems to indicate. Next, show them the same data mapped and discuss what they notice. Ask students: Does this map seem to indicate any patterns? Could we map the same data differently? Would the resulting map be different? What other data would you like to see mapped?
Students can understand how using different map-making strategies affect results using examples of the U.S. Presidential election and electoral votes. "Maps of the 2012 U.S. Presidential Election Results" is available at http://www-personal.umich.edu/~mejn/election/2012/

Development:
Give students, working in pairs, the handout, "Choropleth Maps", and a list of data to be mapped. Note that providing a list of data in graduated order would be easier for younger students to use. Each set of partners should be given a different set of data. Students will map the data using the directions provided. Students title their map and provide a legend. Students will share their maps by posting them and completing the handout. Students will be able to identify correlations among the data, generate hypotheses about the data, and test the hypotheses by suggesting other data to investigate. Students will also be able to identify regions by identifying patterns.

Students will discuss their findings as a class. Questions may include: What "matches" did you identify? What regions were you able to identify? What patterns can you identify? How did making the maps help you understand the patterns? What hypotheses did you make? How would you investigate these hypotheses further?
The teacher will be sure to explain that correlation does not mean causation. That is, the "matching" of two topics do not necessarily mean that one topic caused the other to occur.

Closing:
Discuss the process of choropleth mapping and why mapping data is important. Ask students: How does mapping the data help you to analyze the data? Are regions or patterns of places important to recognize? What problems are there to mapping data?

Extensions
1. Students construct their map using a paint or draw program on the computer. Students use colors or shading in the same manner as described in the handout. Students then analyze their individual maps and develop hypotheses about the data. They compare maps by printing their maps or posting them to a common site in order to construct hypotheses about the several maps.

2. Students generate their own data and map it. Topics might include: What state in the U.S. would you most like to visit? (Students are surveyed and responses compiled.) What states have professional sports teams? (Students include numbers of sports teams per state.)

Assessment
- Map data accurately
- "Choropleth Maps" handout

Website Resources
"Maps of the 2012 U.S. Presidential Election Results" by Mark Newman at University of Michigan
http://www-personal.umich.edu/~mejn/election/2012/
This site provides maps of the 2012 election mapped differently

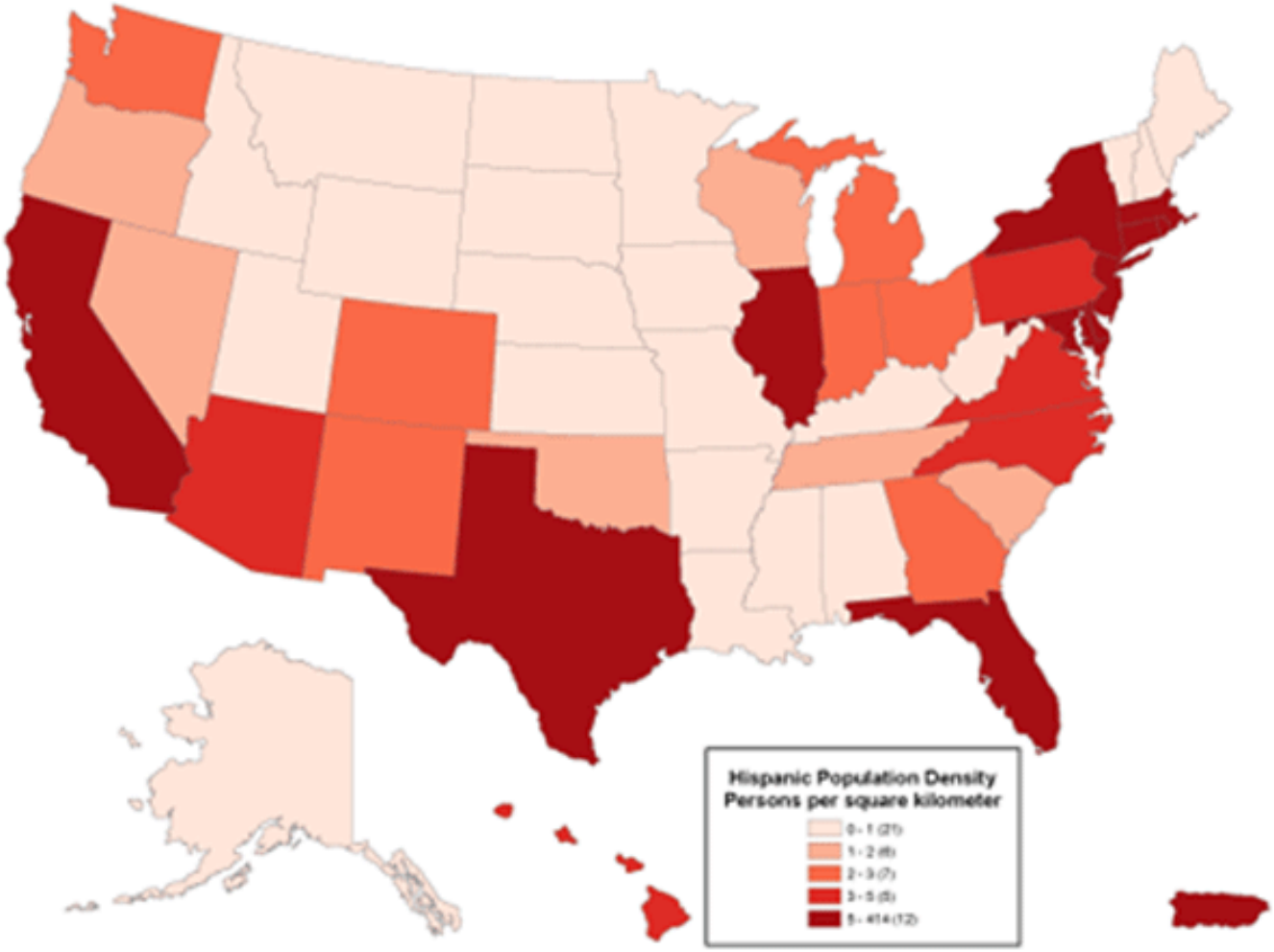
U.S. Census Bureau
http://www.census.gov/
Provides data for states

CIA World Factbook
https://www.cia.gov/library/publications/the-world-factbook/
Provides data for countries

Population Reference Bureau
http://www.prb.org/
Provides data for countries

Choropleth Maps

A choropleth map shows patterns that a list of data cannot clearly indicate. It is able to do this because the data is distributed within the specified areas. An example of a choropleth map is below.



https://www.e-education.psu.edu/natureofgeoinfo/book/export/html/1553

To make a choropleth map, data is grouped or categorized and color-coded by either coloring or shading. The darker color is more intense and shows a greater value; the lighter shading is less intense and shows a lower value. Using the example above, the states with the greatest Hispanic population per square kilometer are shaded darker; those with the lowest Hispanic population per square kilometer are shaded lighter. The map shows that the Hispanic population is greater in certain areas of the U.S. and less in other areas of the U.S. This observation is a generalization that helps us to understand the patterns of distribution of a population in the U.S. We can then pose hypotheses and ask questions about the data. Other populations can be mapped as well as other data, and other patterns can be noted.

Making Your Choropleth Map

You are now ready to construct a choropleth map. Use the data you were given and follow the steps to construct your choropleth map:

1. Find the range of your data. Look at your list of data and identify the highest and lowest value (or highest and lowest number). Subtract these 2 numbers and you will have the range that the data numbers fall within.

2. Determine your categories for the map. Usually, the number of categories is 4 or 5. Divide that number (the range) by the number of categories that you plan to use. Another way to do this is to group the data by similarities. Like numbers are grouped together.

3. Determine the colors or shading that you will use for each category to produce graduated colors. Remember that dark is more; light is less. Complete the Legend on your map. It is important to keep the colors in the same color family. If you use too many different colors, the map-reader will be confused.

4. Sort the data on your list of data to identify its color by labeling each data with its category or color.

5. Color the map using the Legend that you created as a guide. Atlases may be used.

6. Title the map and include the Legend and the Source of the data.

You are now ready to analyze your map.

First, identify regional patterns. Look at your maps to see the distribution. Are the colored places spread out? Are they clustered? Are they **contiguous** or connected to one another? (If your map has **4 places** that are connected, we will label this a 'region'. The places are similar to one another.)

Second, answer these questions about your map:

a) Looking at your map, what places make up the region? _____
_____

b) What region can be identified? Give the region a name. _____

Using the piece of masking tape provided by your teacher, hang your maps on the classroom wall so everyone can see them.

Next, compare your maps with your classmates' maps using the information on the back of this sheet. To do this, find maps that have similarities using all the maps in the classroom. You should be looking for maps with matching places. A 'match' is any two maps that have 4 connected places in common. Write the titles of the two maps for each match. List as many matches as you can.

	Matches	
	Matches	
	Matches	
	Matches	
	Matches	

6. Why do you think these topics 'match'? List as many ideas as you can. These will become your hypotheses.

What questions would you need to ask to investigate whether this is a legitimate relationship? Write 3 questions about the matches:

1.

2.

3.