Introduction to Maps
I. Using Paper Maps
II. Mapping on the Web

SCIENCE SUBJECT: Earth Science, Integrated Science, Physical Science

GRADE LEVEL: 6-12

SCIENCE CONCEPTS: Map use

VOCABULARY: map, scale, theme, Geographic Information System (GIS), spatial patterns, demographics

LESSON SUMMARY: In this activity you will learn what a web based GIS is and use one to explore the area around your school and home. Estimated time: 1 hour hour, 30 minutes (30 minutes on part 1, 1 hour on part 2). Summary questions may be completed as homework.

STUDENT LEARNING OBJECTIVES:
1. Explain what ‘GIS’ stands for and what a GIS can do.
2. Compare and contrast a GIS to a traditional paper map.
3. Be able to navigate a web GIS interface with comfort.

MATERIALS:
1. Paper maps of your state and local area. These could include AAA maps of your city and state, USGS topographic maps and any other maps you may have in your classroom that include your city. Try to have enough maps that groups of 3-5 students can share a map. You could have students pass around the different maps (state, city etc) so that each group gets to look at each map.
2. A computer lab with an internet connection and a web browser such as Internet Explorer or Firefox.
3. Copies of the attached worksheet.

BACKGROUND INFORMATION:
- A map is a picture of the world, reduced so that it fits on a piece of paper. It is an abstraction of reality. In other words, on maps objects are not often photo-represented, but rather are represented by dots, lines or polygons.
For example, a road may be represented by a line. A city might be represented by a dot.

- Maps can show many different things, from roads, to cities, to parks, to land use or weather.
- A map is a way to communicate information.
- Maps have different scales. The scale of the map is the ratio of the distance on the map to the distance on the ground. The map scale shows you how 'zoomed in' or 'zoomed out' you are. A scale such as 1 inch = 1 mile (or 1:63,360) shows a small area of the world such as your city. A scale such as 1 inch equals 250 miles (1:16,000,000) shows a large area such as your state.
- Some maps show a lot of information (like the AAA map of your city). Others show only one thing (like a weather map). Each category of thing that the map shows is called a theme. Examples of themes are 'roads', 'cities', 'parks', 'rivers' and 'lakes'.
- Themes usually have information associated with them. For example, the theme 'roads' on a map might have information associated with it such as the name of the road, the type of road surface (paved, gravel etc) or the speed limit of the road.
- Scientists look for spatial patterns in maps. A spatial pattern is a grouping of a category of themes that prompt you to investigate further. For example, on a map of 'high school completion rate by county' in California, you might notice that counties with a high level of completion rates are grouped near the coast, while counties with very low levels of completion rates are grouped in the central valley. This spatial pattern may prompt you to ask more questions, such as, “what factors might be responsible for more people in the Central Valley dropping out of high school, while more people near the coast complete high school?” You might want to look at a map of income levels, industries in the region, urbanization etc.
- Demographics refers to the statistical characteristics of human population, especially with reference to size, density, distribution and vital statistics.
- A computerized map is called a Geographic Information System or GIS.
- A GIS can take a lot of different paper maps and display them together or separately, and let the user find out the information about each of the themes. Because a computer does not have to show all of the information that it has about a map at one time, a GIS can store a lot more information than a paper map can.

**ADVANCE PREPARATION:**
- Assemble your collection of paper maps (part 1).
- Make copies of the attached worksheet for each student in the class.
• Reserve the class computer lab (part 2).

PROCEDURE:
1. Introduce the background information to the students.
2. Divide the students into groups and distribute a paper map to each group.
3. Have the students complete part 1 of the worksheet using the various paper maps in the class.
4. Move to the computer lab, and have the students complete part 2 of the worksheet using a web GIS.

EXTENSIONS:
• Have your computer support specialist install Google Earth on your lab computers and have the students explore their local area on Google Earth

RESOURCES/REFERENCES:

STANDARDS:

National

California Investigation and Experimentation
1. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations. Students will:
   a. Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
   h. Read and interpret topographic and geologic maps.
Introduction to GIS on the Web Worksheet – Teacher copy

Directions: Answer the following questions using the maps your teacher has provided.

Answer the following 5 questions about each of the paper maps

1. What area or region does this map show? Is it a large part of the world, or a small part of the world?

2. What is the scale of this map (look at the bottom of the map). Scales are usually written as a ratio such as 1 inch = 1 mile, or 1:63,000.

3. What themes are shown on this map?

4. If you were traveling and using this map, what kind of information would you like to know about each of the themes that you listed for #3? For example, for the theme 'roads' you might want to know if the road is paved, what the name of the road is, and the speed limit on the road.

5. What information does the map actually show about each of the themes that you listed in #3?

Part 2: Mapping on the Web
Open your web browser and type in the web address: http://nws.noaa.gov/. This will take you to the National Weather Service web site.

1. What area or region does this map show? Is it a large part of the world or a small part of the world?

The theme of this map is 'weather warnings and forecasts'. Look at the key below the map to see what type of weather each color represents.

Place your mouse over your local area and click once. This will allow you to zoom into a smaller area and view it in greater detail.

2. Based on the map key, are there any weather warnings or advisories for your local area? What are they?
You can also place your mouse over the name of the weather warning and click to view more information about the weather warning.

Use the back arrow on your web browser to go back to the map. Place your mouse over your city and click to view a forecast for your city.

You can also type in your city name or zip code into the box at the upper left side of the window:

3. What are the forecasted high and low temperatures for today and tonight?

End of part 2a. Go to next page for part 2b.
Next, we will visit data from the 2000 US Census. Every 10 years the US government counts the number of people in the United States with the census. They also take a lot of demographic information, and provide it to the public in the form of maps and tables. You can explore this data on the US Census web site.


Under the heading ‘People’ select ‘Percent of the population who have completed high school, 2006’

Use the legend on the left side of the screen to identify what each color value on the map means.

4. Based on the title of the map, what data does it show?
5. What features are shown on this map?
6. What percentage of people over age 25 in California have high school degrees?
7. Is this more or less than the percentage of people in Oregon over age 25 who have high school degrees?
8. Do you notice any general spatial patterns in this map? What are they? What other factors do you think might contribute to this pattern?

Next, we are going to look at your county and the counties around you. Use the pull down menu above the map to view by county, then select the '+' button above the map, then position your cursor over your state and click to zoom in. Repeat this until you can see your county and the counties surrounding it.

Use the identify tool (next to the zoom, with the letter ‘i’) to identify your county.

9. What percentage of people over age 25 in your county have high school degrees?

10. Is this more or less than the state? Why do you think that this is the case?

Finally, you can test your ideas from #10 by viewing maps of other data. At the top of the page, click on ‘Themes’ to change the theme shown on your map. Select a theme and click on 'show result'. Try the following: M0101 Median Age of the total population, 2006: M0501 Percent of people who are foreign born, 2006: M1901 Median Household Income.
11. Of the three themes listed above, which do you think most closely relates to the high school completion rate? Why? Are there any other themes that you think might influence high school completion rates?

Part 3: Summary questions

Answer each question on below.

1. Compare and contrast the amount of information that the paper map contained, with the amount of information that the computerized maps contained. Your answer should be about one paragraph.

2. What advantages do you think that the National Weather Service web site would have over a paper map of the weather forecast? Your answer should be about one paragraph.

3. What advantages do you think that the census website maps would have over a paper map? Your answer should be about one paragraph.

4. What does the term 'GIS' stand for? Based on your experiences with paper maps and the web-GIS sites you visited, how is a web-based GIS different from a paper map? Your answer should be about one paragraph.
Introduction to GIS on the Web Worksheet - Student Copy

Directions: Answer the following questions using the maps your teacher has provided.

Answer the following 5 questions about each of the paper maps

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   Map 2 .................................................................................................................
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Map 2  ________________________________________________________

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Go to http://factfinder.census.gov/ On the left side of the page, select 'Maps' -> Thematic Maps.

Under the heading 'People' select 'Percent of the population who have completed high school, 2006'

Use the legend on the left side of the screen to identify what each color value on the map means.

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Answer each question on a separate sheet of paper.

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