

INTRODUCING SPATIAL THINKING SKILLS ACROSS THE CURRICULUM

Spatial Thinking Skills are an important set of competencies for examining the world around us. These skills enable the geographer to visualize and analyze spatial relationships between objects, such as location, distance, direction, shape, and pattern. Any issue or event can be viewed spatially: the spread of disease, earthquake activity, trade, immigration, and so forth. Geography's unique spatial perspective makes it an ideal starting point for interdisciplinary instruction. If we want to foster problem-solving and analytical skills in our classrooms, then we must infuse our curricula with content and activities that support the development of Spatial Thinking Skills. Eight fundamental Spatial Thinking Skills are listed below.

SKILL	DEFINITION	EXAMPLE
COMPARISON	Comparing one place with another...	e.g., rainfall, income, satellite images, maps, graphs
AURA	Describing the influence that a place can have on neighboring locations...	e.g., smoke from a factory, noise from a highway, property value near a park
REGION	Drawing a line around all places that have similar characteristics or are linked together in some way...	e.g., Corn Belt, Ozark Highlands, Polish neighborhood, Tornado Alley
TRANSITION	Describing what happens between two places with known conditions...	e.g., Do features change gradually or abruptly from one place to another?
ANALOGY	Finding places on other continents (or in other cities, mountains, etc.) that have similar positions and therefore have similar conditions...	e.g., Mediterranean climate, subduction zones, inner ring suburbs
HIERARCHY	Identifying a spatial hierarchy, or how 'nested' features relate to one another...	e.g., river networks, distribution hierarchies, political hierarchies (town, county, state, country)
PATTERN	Describing the arrangement of features or conditions in an area...	e.g., evenly or unevenly spaced, clusters, donuts, strings
ASSOCIATION	Identifying the extent to which features have the same map pattern...	e.g., malls and freeway exits, malaria and anopheles mosquitoes



EXPLORING RELATIONSHIPS WITH CORRELATION GRAPHS

Lesson Overview:

Correlation graphs, or scatterplots as they are also called, enable us to explore the relationship (“association”) between variables. A positive relationship implies that as one variable increases, the other one does as well. A negative relationship is the opposite: as one variable increases in value, the other one decreases. In this lesson, students will plot the relationship between Income (GNP per Capita) and Life Expectancy to see if there is an “association” between these two variables.

Objectives:

- * Students will plot GNP per Capita and Life Expectancy data points on a Cartesian coordinate system to create a scatterplot.
- * Students will describe and interpret a scatterplot to determine if GNP per Capita and Life Expectancy are “associated.”

Geography Standard 1: Use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.

Math Standard, Data Analysis and Probability: Discuss and understand the correspondence between data sets and their graphical representations, especially histograms, stem-and-leaf plots, box plots, and scatterplots.

Materials:

- * Student Worksheet:
INCOME & HEALTH: IS THERE A CONNECTION?
- * Transparency of worksheet

Getting Started:

Tell students that telling students that they are going to learn about a strategy for determining the relationship between two variables. Write the words **income** and **health** on the board and ask the class to think of ways these two things might be related. For example, income may affect factors that influence health, such as a person’s diet or their ability to pay for health care. On the other hand, poor health may reduce a person’s ability to earn income. Explain that students will use income and health data to investigate whether there is a relationship between these two variables. Distribute the Income & Health worksheet to students.

Using the Student Worksheet:

Be sure students understand the definitions of the two variables: GNP per Capita and Life Expectancy. (NOTE: They will use GNP per Capita as a surrogate for personal income, but it is important that they realize these statistics are not synonymous.) Ask students to suggest and write a specific hypothesis about a possible relationship between GNP per Capita and Life Expectancy. For example, places with the lowest GNP per Capita will have the lowest Life Expectancy.

Have students create a scatterplot to make it easier to test their hypothesis. Point out that on this graph, the independent variable (GNP per Capita) is on the x-axis and the dependent variable (Life Expectancy) is on the y-axis.

Model the process of plotting points on the graph using the data for Northern Africa, then provide time for students to plot the remaining points. The finished scatterplot will look like the one on the right.

Key Terms:

GNP per Capita: the dollar value of a country’s final output of goods and services (Gross National Product) in a year, divided by its population. GNP per Capita is used to compare economic standards of living between countries.

Hypothesis: an “educated guess” or thoughtful attempt to explain why things might be related.

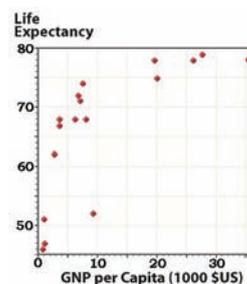
Life Expectancy: an estimate of the number of years a newborn will live based on current conditions.

Wrapping Up: Use the questions on the worksheet to discuss the interpretation of the scatterplot. The discussion should include:

- * *Regions with higher GNP per Capita tend to have higher Life Expectancy than the regions with lower GNP per Capita.*
- * *Among regions with low GNP per Capita, even a*

small difference in GNP is reflected in a significant difference in Life Expectancy. For the regions with high GNP per Capita, the differences in Life Expectancy are relatively small.

- * *Southern Africa is an example of an outlier: its Life Expectancy is much lower than that of other regions with similar GNP per Capita. A per Capita rate does not take distribution of wealth into account. In southern Africa, a small percent of the population controls most of the wealth, while the majority of people do not enjoy the benefits of the region’s overall economic well-being.*
- * *The graph shows that Life Expectancy and GNP per Capita are “positively” related—as one goes up so does the other. Another way of saying this is that high GNP per Capita is “associated” with high Life Expectancy. This does not necessarily mean that higher income causes good health. This is an important distinction.*



Extensions:

- * *Create a scatterplot of GNP per Capita and Infant Mortality to see an example of “negatively” related variables.*
- * *Use a graphing calculator to identify the equation that best suits the data.*

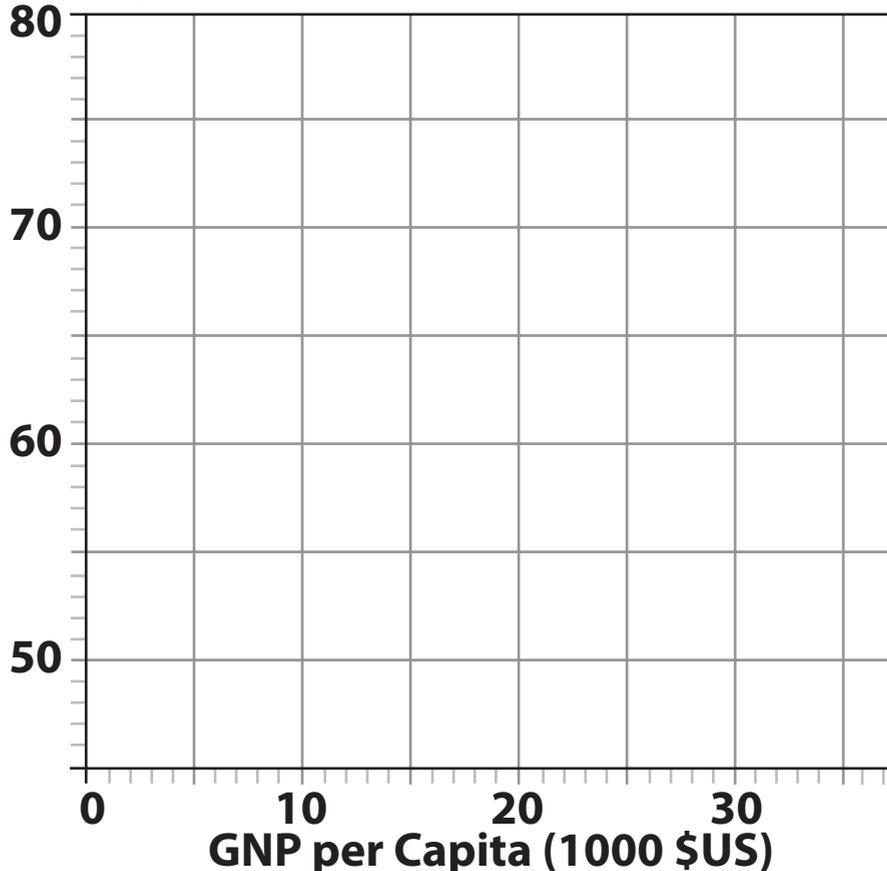
INCOME AND HEALTH: IS THERE A CONNECTION?

Region	GNP per Capita (in dollars)	Life Expectancy
Northern Africa	3680	67
Western Africa	1070	51
Eastern Africa	950	46
Middle Africa	1130	47
Southern Africa	9300	52
North America	35390	78
Central America	7580	74
South America	6970	71
Oceania	19960	75
Western Asia	6100	68
South Central Asia	2620	62
Southeast Asia	3690	68
East Asia	6790	72
Northern Europe	26040	78
Western Europe	27520	79
Eastern Europe	8030	68
Southern Europe	19680	78

Use the numbers in the two columns from the data table to locate points on the graph below. When you have completed your scatterplot, use it to answer the questions below.

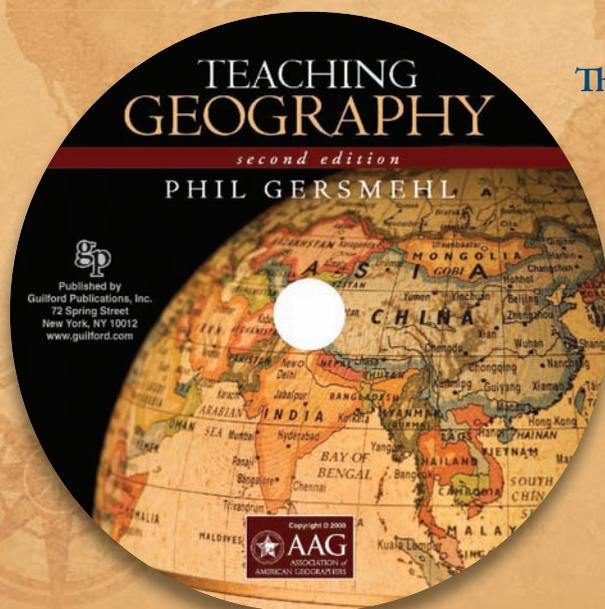
1. What is the general pattern shown on the graph?
2. How does the pattern differ between regions with a GNP Per Capita under \$10,000 and a GNP Per Capita of over \$20,000?
3. How does Southern Africa differ from other regions? Can you think of a possible explanation?
4. Does this graph prove that high income causes good health? Why or why not?

Life Expectancy



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Spatial Thinking - Math