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

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COMPARING THE ERIE AND PENNSYLVANIA CANALS

Lesson Overview:

Students will compare the Erie and Pennsylvania Canals and identify the geographic factors that gave the Erie Canal a significant advantage over its Pennsylvania counterpart. They will also compare the impact of the two canals in terms of agricultural development and the growing supremacy of New York City over Philadelphia.

Objectives:

* Students will describe the geographic characteristics of the pathways chosen for the Erie and the Pennsylvania Canals.
* Students will explain factors that gave the Erie Canal an economic advantage over the Pennsylvania Canal.

Geography Standard 17: How to apply geography to interpret the past.

United States History Standard 2A, Era 4: How the factory system and the transportation and market revolutions shaped regional patterns of economic development.

Materials:

* Student Worksheet: THE ERIE & PENNSYLVANIA CANALS
* Transparency of worksheet
* Highlighters or colored pencils (several different colors)

Key Terms:

Lock: a chamber whose water level can be varied for raising and lowering boats between stretches of water of different levels on canals.

Infrastructure: Canals, roads, power lines, and other built features that support human activity and link places.

Getting Started:

List the following terms on the board and ask students what they have in common: roads, water supply system, power lines, computers. Introduce the concept of **infrastructure** (see box). Components of infrastructure are often built and managed by governments. Building infrastructure can be expensive, but it can have a significant impact on a community's success. Challenge students to think of examples. Explain that students will examine an example of infrastructure constructed almost 200 years ago that still has an impact today.

Using the Student Worksheet:

Distribute student worksheets. Explain that the Erie Canal was completed in 1825 and its success triggered Pennsylvania to build a canal to compete with it. The Pennsylvania Canal was completed in 1834.

Use the worksheet transparency to model completion of the directions next to Map 1. Give students several minutes to confer with a partner about the discussion questions below Map 1. Ask student pairs to share their answers and particularly their reasoning on questions 3 and 4.

1. *along Erie Canal then down the Hudson River to NYC*
2. *NY had higher wheat production. Most of NY's wheat production was in western NY, along the Erie Canal.*
3. *More was probably shipped to NYC than to Philadelphia because there was significantly more wheat production along the Erie Canal. (NOTE: Upstate NY's wheat producing region had mushroomed since the completion of the Erie Canal in 1825.)*
4. *Answers will vary. Point out that flour is lighter and less perishable than wheat. By converting wheat to flour before shipping, transport costs would be reduced.*

Explain that Map 2 will provide some insight into the difference between the two canals. As a class, follow the directions and calculations next to Map 2.

NOTE: These student calculations are simplifications of the actual numbers, but they will allow students to get a true picture of the difference between the canals.

Elevation Change - *Erie: 450 ft. Pennsylvania: 2,200 ft. (student numbers may vary)*

Number of locks required - *Pennsylvania Canal would require 5 times as many locks*

Additional length of time for full canal trip due to locks: *Erie Canal: about 24 hours Pennsylvania Canal: about 110 hours (4.6 days) (NOTE: This is a very rough calculation which assumes that all elevation changes would be accomplished with locks. The PA Canal actually used a different system because locks alone could not accomplish the task. The important point is to recognize the time difference between a relatively flat canal and one with significant elevation changes).*

Wrapping Up: Conclude the lesson by discussing student responses to the questions beneath Map 2.

1. *The sharp spike in elevation on the PA Canal graph suggests a mountain. The canal had several elevation changes, especially in the piedmont and mountains. On the other hand, once the Erie Canal rises above the banks of the Hudson River, the canal path is relatively flat.*
2. *Possible answers:*

* *NY had higher wheat production than PA (shipping agricultural products from the interior to the coast was a major purpose of the canals);*
* *The Erie Canal was located very close to productive agricultural regions;*
* *A relatively flat canal meant that movement on the Erie Canal was not slowed down as much by the need to use locks—therefore goods would reach the coast faster via the Erie;*
* *The Erie Canal had a 10 year head start on the PA Canal.*

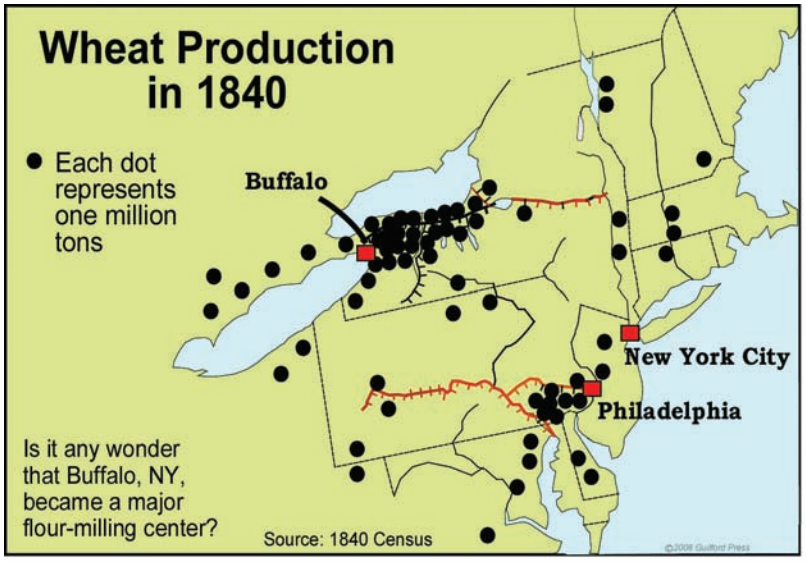
Extensions:

* On a map, locate the 10 largest cities in New York and compare their locations to that of the Erie Canal.
* Identify and compare other transportation canals built in the United States during the same period.

Name_____

THE ERIE & PENNSYLVANIA CANALS

Map 1



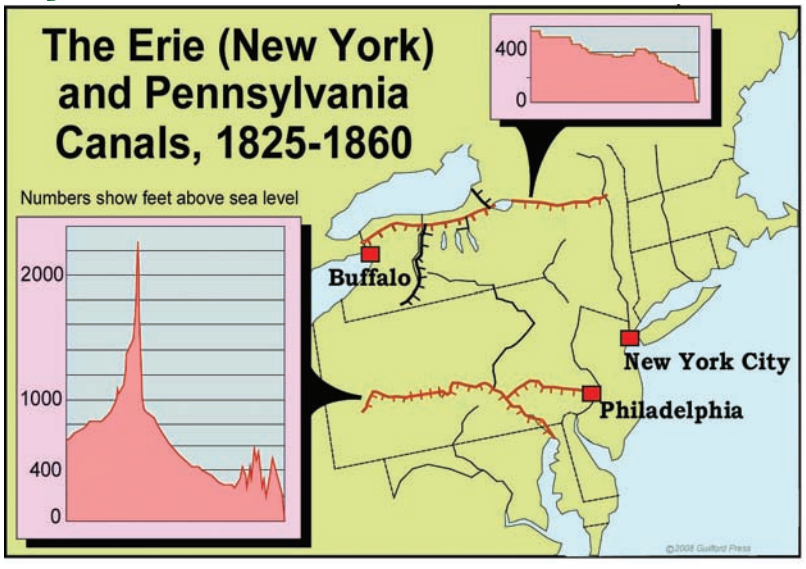
Directions:

- Outline (or lightly color in) and label Pennsylvania (PA) and New York (NY).
- Label the Hudson River and highlight it with blue (highlighter or colored pencil).
- Highlight the Erie and Pennsylvania Canals. HINT: use Map 2 as a guide to help color the sections that are difficult to see.

REFER TO THE MAP TO ANSWER THE FOLLOWING QUESTIONS:

1. How would goods shipped from Buffalo use the Erie Canal to reach New York City?
2. Which state, Pennsylvania or New York, had higher wheat production in 1840? In that state, where were the wheat producing regions located in relation to the canal?
3. In 1840, do you think more wheat was shipped from the eastern Great Lakes region to New York City or to Philadelphia? Why?
4. Why would it be advantageous to convert wheat to flour before shipping it?

Map 2



Directions:

- On each graph place a dot that indicates the elevation of the canal at its highest and at its lowest points.

Calculations:

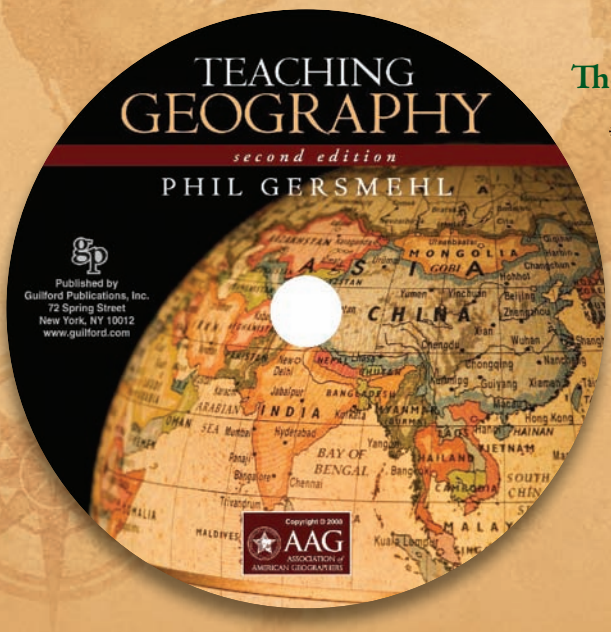
- What was the approximate total change in elevation (highest to lowest point) for each canal?
- If a lock can raise or lower a canal boat about 10 feet, approximately how many locks would each canal need?
- If each passage through a lock takes 30 minutes, approximately how much time would be added to the overall trip on each canal?

REFER TO THE MAP TO ANSWER THE FOLLOWING QUESTIONS:

1. What do these two graphs tell you about the landforms along the pathways of the Erie and Pennsylvania Canals?
2. The Erie Canal brought greater prosperity to upstate New York and New York City than the Pennsylvania Canal did for the western part of that state or for Philadelphia. Use information on the maps or your answers to previous questions to identify some reasons why the Erie Canal was more successful than its Pennsylvania counterpart.

FOSTERING SPATIAL THINKING SKILLS IN THE CLASSROOM

The *Teaching Geography* CD-ROM can help you design lessons and activities that promote spatial thinking. This interactive CD accompanies Phil Gersmehl's *Teaching Geography*, but it is a fully independent, stand alone resource as well. It includes lessons that are cross referenced by World Regions, Maps and Tools, and Spatial Thinking categories. The CD's lessons introduce, explain, and demonstrate each of the aspects of spatial thinking: comparison, aura, region, transition, analogy, hierarchy, pattern, and association. The CD also introduces three related skills for spatio-temporal thinking: change, movement, and diffusion.



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Teaching Geography CD-ROM	$ 25.00
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This product was developed in partnership with the National Council for Geographic Education (NCGE) with funding from the FIPSE program in the U.S. Department of Education. For more information about the CD and related resources, visit the AAG's Teacher's Guide to Modern Geography website at www.aag.org/tgmg.