

Analyzing Your School's Quadrangle

Strand Scientific Investigation

Topic Developing Map Skills

Primary SOL ES.1 The student will plan and conduct investigations in which

- a) volume, area, mass, elapsed time, direction, temperature, pressure, distance, density, and changes in elevation/depth are calculated utilizing the most appropriate tools;
- c) scales, diagrams, charts, graphs, tables, imagery, models, and profiles are constructed and interpreted;
- d) maps and globes are read and interpreted, including location by latitude and longitude.

Related SOL ES.2 The student will demonstrate an understanding of the nature of science and scientific reasoning and logic. Key concepts include

- a) science explains and predicts the interactions and dynamics of complex Earth systems;
- c) observation and logic are essential for reaching a conclusion.

Background Information

Mapping has been a necessity since the beginning of exploration and travel. Prior to established cartography (map making), individuals traveled only short distances in search of food. As time progressed, the need for further travel became evident. Through map making, it became possible to travel great distances and return in a pre-established route. These maps included scales, legends and other defined symbols. This allowed the map to be used by multiple people and retain the purpose of the map. Over time cartography techniques have improved from hand drawn maps to the satellite precision maps that we have today. Scientists often use maps to georeference their data.

Students will compare maps of different scales while reading and interpreting maps, legends, lines, and symbols used on topographic maps. Students will locate points and directions using latitude and longitude; determine distance and elevation on a topographic map; identify features such as hilltops, streams, and valleys; and construct profiles using contour lines.

This activity is written generically so that it can be used with many different USGS quadrangles. Therefore, you will need to preview the activity and insert into the questions the names of features to be studied that are specific to your location. Note that not all observations are applicable to every quadrangle.

Materials

- USGS quadrangle topographic map (7.5-minute series) that includes your school
- USGS maps and information - <http://topomaps.usgs.gov/>

- USGS map locator and Downloader - [http://store.usgs.gov/b2c_usgs/usgs/maplocator/\(ctype=areaDetails&xcm=r3standard_pitrex_prd&carearea=%24ROOT&layout=6_1_61_48&uiarea=2\)/.do](http://store.usgs.gov/b2c_usgs/usgs/maplocator/(ctype=areaDetails&xcm=r3standard_pitrex_prd&carearea=%24ROOT&layout=6_1_61_48&uiarea=2)/.do)
- USGS Quad Locator - <http://www.usgsquads.com/index.php/map-indexes/mapfinder/>
- Rulers
- Calculators
- USGS Quadrangle Activity handout (attached)

Vocabulary

contour interval, contour line, degrees, elevation, geographic north, graphic scale, index contours, latitude, longitude, magnetic declination, magnetic north, minutes, representative fraction scale, seconds, topography, total relief

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

This lesson focuses on the discoveries leading to the development of general map reading and creation. Students will utilize the thought questions to begin to gain a better understanding of how maps work and their key components.

1. It would be helpful for the students to complete a Know, Want to Know, and Learned (KWL) chart to track their learning of the material. Attached is an example of a KWL chart, to be filled in as a group or by the individual student.
2. After they have completed the first two columns in the KWL chart have them work on the thought question by working as a group to complete the map of the school on their own without the use of a pregenerated map. Make sure that they know that they are to generate a map and have them write down directions using their own legend and key to a predetermined location or item (i.e., home base plate of the baseball field).
3. Have the students also come up with a scheme for determining the elevation of the landscape relative to others. (NOTE – The students can return to this map after gaining a better understanding of topographic maps and draw in their own contour lines.) As a quick follow up, have them write down any problems they encountered along the way while generating the map or coming up with directions.
4. Explain to students that they are going to work in groups to study and analyze a type of map called a 7.5-minute series quadrangle. Emphasize that they will need to use their understanding of the terms and concepts to complete their observations.
5. Put students into groups of three to five, and provide each group with a USGS quadrangle and a copy of the attached USGS Quadrangle Activity handout. Have students in each group work together to complete the handout.

Assessment

- **Questions**
 - See USGS Quadrangle Activity questions.
- **Journal/Writing Prompts**
 - Have each student develop three to five observation questions about the topographic maps and create a separate key for the answers. Then, have students exchange

questions with partners and answer the questions. When they are finished, have partners review the answers to the questions, using the answer keys they created.

- **Other**
 - Display topographic maps of various areas. Post two or three observation questions that are specific to each map, and instruct students to individually examine the maps and respond to the questions about them.

Extensions and Connections (for all students)

- Have students select lines along a displayed map and construct topographic profiles for those lines. Have them use various levels of vertical exaggeration to construct the profiles.
- Have students explain the need for a known coordinate system and common set of map symbols.
- Have students develop three to five observation questions of their own for the topographic maps from various areas and provide a key for solution.

Strategies for Differentiation

- Use the human body (i.e., arms stretched outward to represent lines of latitude; line drawn from head to feet to represent lines of longitude) to reinforce understanding of latitude and longitude.
- Reinforce understanding of topographic profiles by having students draw the human face from straight-on and in profile. Relate the straight-on drawings to the view seen on a topographic map, and relate the profile view to what is shown on a topographic profile.

USGS Quadrangle Activity

Pre-Lesson Activity:

- Complete the KWL chart.
- Using only a piece of paper and pencil, is it possible to draw an accurate map of the school grounds that could be used by another person to find a place of interest and their relative elevation?
- Can you devise a way to come up with a location for your school as it sits on the globe that does not use a latitude or longitude coordinate system?

KWL Chart

K - know	W - want to know	L - learned

1. List the quadrangle title, publisher, and year.
2. What is the representative fraction scale?
3. Use the graphic scale to determine how many feet are represented by one inch.
4. Determine the following in degrees, minutes, and seconds:
 - a. The latitude at the top of the map
 - b. The latitude at the bottom of the map
 - c. The difference in latitude between the top and bottom of the map
 - d. The longitude on the left side of the map
 - e. The longitude on the right side of the map
 - f. The difference in longitude between the left and right sides of the map
5. Why is this map called a “7.5-minute series” topographic map?
6. The USGS also publishes a 15-minute series topographic map with a scale of 1:62,000.
 - a. Which series shows a larger area of Earth’s surface?
 - b. Which series has the smaller scale?
7. What is the contour interval of the map?
8. In what color are contour lines shown?
9. Every _____ (*ordinal number*) contour line is darker and numbered. What are these contour lines called?
10. What is the difference in elevation between index contours?
11. What does the purple color on the map represent?

12. According to the map, what is the magnetic declination?
13. What are the highest and lowest points on the map? What is the total relief? Show your calculations.
14. Identify an area with a steep slope. How did you determine this?
15. Identify an area that is relatively flat. How did you determine this?
16. What is the elevation of your school?
17. Locate your school, and determine the following:
 - a. Latitude (in degrees, minutes, and seconds)
 - b. Longitude (in degrees, minutes, and seconds)
18. What is the straight-line distance in miles between (*insert your school or feature*) and (*insert feature*)?
19. Creeks, streams, and rivers are shown in what color?
20. Locate (*insert stream/creek/river*).
 - a. In which direction is it flowing?
 - b. How do you know which way it is flowing?
21. What is the elevation in feet of (*insert feature*)?
22. What is the symbol for a railroad?
23. What is the symbol for a campground?
24. Identify at least three buildings and/or related features on the map.
25. What is the road distance of (*insert road/route number*) on this map?