Topographic Maps: Representing Elevation on a Flat Sheet of Paper

Objectives:
The following are a series of activities to allow students to grapple with and eventually understand the nature of and problem solved by topographic maps. In addition, students will also learn to read standard topographic maps.

I. Creating and Mapping Your Hill

A. Making your hill

Materials:
- 2-3 pounds of plasticine per pair or group of students
- Small landscape features: Monopoly houses, tiny cars and trees, yarn, or streams, toothpicks etc.

Divide the students into small working groups. Give each group 2-3 pounds of plasticine clay. From this clay, they have a short amount of time to construct a hill with various features on it. Tell the students they are to make a "really cool hill, with lots of detail". Encourage them to add streams, structures, vegetation, and to vary the topography with gullies and even multiple peaks. Give sufficient time, at least 10-15 minutes, perhaps more if needed.

B. Trying to draw your hill in 2 dimensions.

Materials:
- Paper, preferably unlined
- Pencils and erasers

Challenge the students to represent their hill on a flat sheet of paper with only one drawing or diagram, including all of their wonderful detail. Many will make careful perspective drawings. Challenge those who do to represent all sides, not just the one seen in the perspective drawing. Give them enough time to try to solve the problem with multiple possible solutions, but not so much that they get overly frustrated (they will get frustrated, however).

C. What are Contour Lines?

Materials:
- A large waterproof basin, preferably clear
- A nicely constructed hill of your own
- Water, in a bucket or other container
- A way to pour the water
- String
- Ruler
- Paper, unlined
- Marker

1. Explain that you are going to show them a way that people have developed to solve the problem of representing an uneven surface, such as a hill, on a flat sheet of paper.

2. As the teacher, put your hill into the clear container. Make sure everyone can see the hill inside. Tell them to watch from a bird's eye view. You may need to put the container on the floor or a low stool.

3. Have a student hold a ruler against the side of the container. Carefully pour water into the container until it is 1" deep. Have the kids look at it carefully. Take the string, and run it around

the hill at the water level. (Press the string into the clay tightly so that when the water is later removed, the string will remain in the clay.) Ask the students what shape the string makes. Draw that shape on the paper and label it 1". Discuss why you labeled it 1" (because it has an elevation of 1" above the bottom of the hill).

4. Pour in water until it is 2" deep. Make a second string line. Draw that string line inside the 1" line on your paper. Label it 2". Continue until you reach within an inch of the top of your hill. Ask the students how your drawing represents the hill.

5. Add any features to your map, such as a house or a bridge that was on your hill. Be sure to model making a key for any feature added this way. Ask for questions and discussion.

D. Aerial View Visualization Activity

Materials: Aerial photographs and/or maps; digital camera

Show the students some aerial photographs and challenge them to identify what objects they are looking at. What clues do they use? What surprises them about how the objects appear compared to what they are used to seeing?

Ask the students how the contour map you just demonstrated is similar to an aerial photograph?

E. Making a Topographic Map of Your Hill

Materials: Same materials as above, but for each group of students with a hill of their own

1. Challenge each group to create their own topographic map of their hill, adding as much detail as possible. Remind them that a key is essential. Remind the students also to press the string into the clay tightly so that when the water is later removed, the string will remain in the clay.

2. Have the students take a digital photograph of their hill from directly above, once they have embedded the string contour lines in the clay.

3. If students seem to be having trouble with this exercise, you may want to stop and display some of the photographs and help them see that, essentially, they are drawing the lines exactly as they see them in the photograph.

4. Give them sufficient time to construct their maps. As they finish, post the maps on a bulletin board in the classroom or hall. When they all have finished, give them time to look at each other's maps. Keeping the discussion positive, discuss what features of the maps seem to work well.

II. Reading and Using Topographic Maps

A. Topographic Map Scavenger Hunt

Materials:

- USGS topographic maps that include the area of your school. Laminate them beforehand if possible.
- Copies of the USGS topographic map scavenger hunt. Change it as needed for the map you may be using.
- Copies of the symbols used on USGS topo maps for each group

1. Pass out the topo maps. Ask them what they can tell from the map. Remind them about their own maps and introduce the term contour line if you have not already done so. Ask them to find

contour lines close together and ask what it means. Do the same for far apart. Then challenge them to use the map to complete the scavenger hunt. Provide assistance as needed.

2. Included is a reading that might make a good homework assignment: "Rules for Topographic Maps"

B. Creating a Vertical Profile

Materials:

- Topographic Map of your Area
- Ruler
- Pencil

Choose two points on the map, sufficiently far away and with interesting topographic features in between them. The task for the students is to

1. Create a "vertical profile" between these two points

2. Make a list of landmarks along this path (such as trees, stream, buildings, etc.) in the order that you cross them.

3. On their topographic map, draw the easiest route to get between the two points.

C. Using a Topographic Map for Navigation

Take the students hiking and have them navigate using the Topographic Maps!

D. Activities for Reinforcement and Clarification

A great resource for additional activities is "Your Way with Map and Compass- Orienteering" by John Disley. Unfortunately it seems that this book is out of print, but if you can track it down it will be worth your while!