ELEVATION AND CONTOUR MAPPING

GRADE: 4-8

TIME: 2-3 (45 minute) periods

MATERIALS: Relief map, map of classroom, colored pencils, meter sticks, clay or play dough, freezer paper, cutting instrument*.

THEMES: Place, Human-Environment Interaction, Movement

GOAL: To help students understand how a topographical map shows land characteristics, and how to use this tool to describe a place.

OBJECTIVES: Students will be able to:
- Describe the relationship between the distance between contour lines and the rate of incline.
- Identify physical features of place using a topographical map
- Locate ‘best’ location for cultural characteristics and explain reasons for choices.

VOCABULARY:
- Topography: topo (place); graphos (drawn or written); shows 3 dimensional physical features on a flat map.
- Elevation: height above or below sea level
- Graphic relief: shows shape of land usually by using shading or color
- Contour lines: "level" lines. Joins points of equal elevation. Always closed.
- Reference point: point you measure from to determine elevation
- Birds-eye view: what can be seen from the air, as if a bird were seeing it
- Street-level view: what is seen from the ground

TEACHING STRATEGIES: Inquiry, Explanation, Guided Practice

Topic Introduction: Elicit responses on the student's conception of the term “elevation", i.e. "What do we mean when we refer to the elevation of something?" Can you name some things which have elevation?" "What do you use as a reference point when comparing elevations?" Establish the fact that with a map, sea level is the reference point. It may be necessary to define the term 'reference point.'

Discuss other vocabulary words (topography, relief, contour) as words which are used in discussing elevation. If using maps as examples, point out the use of accepted colors (green for lowland, brown and red for highest land forms) on most maps. “Bird’s Eye View” and “Street-level View” are common terms used to tell where the viewer is located.

*cutting instrument: 2 tongue depressors tied together with 10 inches of fish line 2 centimeters from the end of each. A groove on each tongue depressor helps keep the line in place. Use by resting ends on paper and pulling fish line through the play dough.
**Mapping Activity:** Give students a classroom map, telling them this is what the room would look like if you were looking down from the ceiling (bird’s eye view). Can you tell which objects are taller? Each object is actually a contour line, and when colored according to a key, can show the elevations. Agree on colors for the key. What is the reference point?

Pair students up and have them measure the items on the map and, using the key, color code each item. Demonstrate by completing one item together. Have students complete the map with map elements.

**Contour Map Introduction:** Use overheads to give examples of topographic map with contour lines. Illustration I: Use Michigan elevation map. Who might want to know about the topography of Michigan? (*MDOT, builders, hikers, cell phone companies*)

**Contour Map Activity:** Directions for making a contour map of a play dough mountain: (Use freezer paper)

1. Use your play dough to shape a mountain having one side steeper than the other one.
2. Trace around the base of your mountain on your paper.
3. Score your mountain. This means mark a line from the base of the mountain over the top to the base on the other side. Then make another score line at right angles to the first line. Mark where the score lines meet the line you traced on the paper.
4. Use your cutting instrument* to cut across the mountain.
5. Remove the base from your paper. Place the remainder of the mountain back on the paper, being careful to line up the score marks.
6. Repeat steps 2-5 until mountain is completely sliced.
7. Color your map and make a key, letting each line represent 100 feet.
8. Add a lake and a river, and complete your map with these elements: title; compass rose; scale, location grid.

**Management suggestions:**
- *Let them practice one day in groups of 2 and then do the map the second day.*
- *It takes 2 students to complete the cutting - one holds the paper.*
- *Working with the play dough until the mountain is formed should be done on the waxed side of the paper, but the actual cutting and map should be done on the paper side, because pencils don’t work well on the waxed side.*
- *If students are careful, they can keep mountains intact to compare with final drawing. (see evaluation idea)*
- *Play dough will keep several weeks in a plastic baggie.*
**Optional: Applying knowledge:** Have students reconstruct a profile of their mountain using the method shown on the USGS site (http://egsc.usgs.gov/isb/pubs/teach-pack/mapshow/activity4.pdf) Activity 4. After completing Activity 4, page 1, from the website, draw a horizontal line through the highest point(s) of their "bird's eye view" and use vertical lines to connect contour points to a set of lines below that are spaced 2 cm apart. Connecting the intersections should produce a "street level view" of the mountain. Pages 2 and 3 of Activity 4 could be used as extensions of this lesson.

**Concluding Activities:** Students will complete their maps with the 5 map elements: Title, key, compass rose, scale, location grid. They should add a river and a lake. Compare map with mountain. Students should note the large spaces between lines indicate a gentle grade, whereas the narrower the space, the steeper the grade.

**EVALUATION:**
A. Maps can be evaluated for completeness, neatness, correct placement and direction of river and lake (river must start in high land area and end in water; lake must not cross contour lines) and map elements.
B. Students should be able to discuss steepest slopes, and choose areas best for activities such as skiing, hiking, building a house, placing a road or airport. (see Illustration 2)
C. If mountains are kept intact, have students match mountains with maps
D. For older students, use Assessment page.

**EXTENSIONS:**
A. Have students make topographical maps of imaginary places and write stories about them.
B. Map the playground, showing elevations
C. Use contour map to tell an adventure story which includes a chase. Show how hero uses what he knows about elevation to be successful in the chase.

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**PLAYDOUGH**
2 cups flour 	 2 cups water 
1 cup salt 	 3 TBSP cooking oil
1 TBSP cream of tartar 	knead. (It should not stick to your hands) Keep in plastic bag until needed.

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**REFERENCES:**
Muir, Sharon. Teaching Map Skills from a Developmental Perspective. Oakland University
Hammond Essential Map Skills. Hammond Incorporated, 1985
Brodhagen, Kathy. MGA Teacher Consultant, Midland, MI

**RESOURCES:**
"Mapping the World By Heart" 1-800-244-9988
How to Teach with Topographical Maps" by D. Van Burgh (NSTA, 1994)
**Assessment:** Below is a topographic map of an island. The contour interval on this map is fifty feet.

1. What is the elevation at Point A on the map? Greater than _____ feet but less than _____ feet.
2. What is the elevation at Point B? _______
3. What is the elevation at Point C? _______
4. If you were standing at Point A, could you see your friend standing at Point B? _______
5. If you were standing at Point A, could you see your friend standing at Point C? _______
6. On the graph, sketch the topographic profile for line XY
7. On the map, label Point D for the best location of an airport, and write your reasons for choosing this location: ____________________________________________________________

8. **Draw your own contour map:**
   On a separate sheet of paper, draw a contour map of an island. The scale of the map is one inch to one mile. The contour interval is twenty feet. The island is roughly rectangular in shape, being four miles long in the east-west direction and one mile wide in the north-south direction. There is a circular hill on the eastern half of the island. Its summit is 130 feet high. This hill is very steep on its northern side. The southern slope of the hill is very gentle. The highest elevation on the western half of the island is eighteen feet.
   The economy of this island is based on tourism. Mark at least 3 places on the island, and explain a tourist activity which makes use of the topography in that area.
Illustration I:

Who might want to know about the topography of Michigan?

Who might need to know about the topography of Michigan?
1. Which is steeper, A or B?

2. Where would you build an airport, C or D?

3. Where is the lowest land, E or F?

4. Identify at least 2 physical characteristics of the land in the Western Upper Peninsula.

5. Describe a cultural characteristic that might be located in the area which would depend on or adapt to a physical characteristic mentioned in #4.