Creating a Topographical Map

SUBJECT: Science
GRADE: 8
DURATION: approximately two 45-minute class periods
ACTIVITY SUMMARY: Students will use clay models of a landscape to create a topographical map.

OBJECTIVES:
Students will be able to:

1. Interpret topographic maps to identify land and erosional features.

MATERIALS:
Clear plastic box with clear lid, Masking tape, Centimeter ruler, Pencil, Water, Topographical map, Modeling clay, Dry Erase Marker, Clear Sheet Protector

BACKGROUND:
A map is a representation of part of the Earth. There are many different types. On a topographical map, the shape of the Earth's surface is shown by contour lines. Contour lines join points of equal elevation on the surface of the land above or below a reference surface. This means that if you were to walk along the ground represented by a contour line, you would not be going uphill or downhill. Contours make it possible to measure the height of mountains, depths of the ocean bottom, and steepness of slopes. Each contour is a line of equal elevation; therefore, contours never cross. They show the general shape of the terrain. Contours that are very close together represent steep slopes. Widely spaced contours or an absence of contours means that the ground slope is relatively level. The elevation difference between adjacent contour lines, called the contour interval, is selected to best show the general shape of the terrain. A map of a relatively flat area may have a contour interval of 10 feet or less. Maps in mountain areas may have contour intervals of 100 feet or more.

Contour lines have 4 important characteristics:

- All points along the same contour line are at the same elevation.
- All contour lines eventually connect with themselves.
- Contour lines never cross each other.
- Contour lines never split or branch.

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PROCEDURE:

1. Place a strip of masking tape vertically on the outside of the plastic box. Mark off 1 cm increments on the tape, starting on the bottom.
2. Using the modeling clay, build a single hill on the bottom of the plastic box. Be sure the hill is not taller than the box. The hill should be simple with gently rising sides.
3. Pour water into the box until the water level reaches the first mark on the tape.
4. Using the pencil point, make a groove in the clay at the waterline. Make sure the groove goes all the way around the hill.
5. Add more water to the plastic box until the water level reaches the next mark on the tape. Make a groove in the hill at this new waterline.
6. Continue filling the box with water and marking groove lines until the hill is totally submerged.
7. Carefully pour the water out of the model while leaving the clay hill in the box. Then place the lid on the box and tightly tape a clear sheet protector on top of the lid.
8. Have students look at the box from the top and sides. The side is the view we see with elevation. The view from the top is the view the topographic map shows—a series of lines that represent changes in elevation.
9. Use the dry erase marker to trace the grooves on the clay model onto the sheet protector. This will create the topo map. As you look at a topo map, the view from the top is what you are seeing. The centimeter marks can represent 100 feet in elevation gain (the place where each line on the topo map is drawn). If the hill is steep in places, the lines will be closer together. If the slope is very gentle, the lines will be spread far apart.
10. Repeat the exercise building more complex slopes that are steep, gentle, have valleys cutting into it, etc. Compare this topo map to a real topo map of your area. (Note: This activity will work best when the landscape is not just a single hill but when the contour lines resemble a real topo map.)
11. Have students mark the tops of hills on their maps and use arrows to show the direction of water flow. Water will drain down the hills toward the valleys.

EVALUATION:
Students can be evaluated based on their answers to the discussion questions.

EXTENSION:
Obtain a topo map of your area and take a short walk with it. Walk up the places where the lines are close together and feel the steepness. Walk where the lines are spread out and enjoy walking with ease. Look at the landscape and compare it to the map. How useful would a map like this be on a hike? If you were lost? Can this type of map help you locate a watershed? Can it help you predict any areas that might be introducing contaminants to the water supply? What else could you use this kind of map for?

Name: ________________________________

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Day 2

1. Repeat the exercise building more complex slopes that are steep, gentle, have valleys cutting into it, etc. Compare this topo map to a real topo map of your area. (Note: This activity will work best when the landscape is not just a single hill but when the contour lines resemble a real topo map.)
2. Mark the tops of hills on your map and use arrows to show the direction of water flow. Water will drain down the hills toward the valleys.
3. Answer the discussion questions that follow.

ANALYSIS QUESTIONS:

1. What does each line on the map represent? ____

2. The space between contour lines depends on ____

3. What does it mean when the lines are close together? ____

4. What does it mean when the lines are far apart? ____

5. Does the contour interval change between lines on a map, or does it stay the same? _______________________________

6. If the contour interval for your map is 100 feet, what is the highest point on your landscape? _________________________

7. How do you know points on a map are at the same elevation?

TEKS ADDRESSED:

8th Grade

1(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations
1(B) use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems
1(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards
1(D) use appropriate tools such as graduated cylinders, metric rulers, periodic tables, balances, scales, thermometers, temperature probes, laboratory ware, timing devices, pH indicators, hot plates, models, microscopes, slides, life science models, petri dishes, dissecting kits, magnets, spring scales or force sensors, tools that model wave behavior, satellite images, weather maps, hand lenses, and lab notebooks or journals
1(E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence
1(F) construct appropriate tables, graphs, maps, and charts using repeated trials and means to organize data; (G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and
2(A) identify advantages and limitations of models such as their size, scale, properties, and materials
2(B) analyze data by identifying any significant descriptive statistical features, patterns, sources of error, or limitations
2(C) use mathematical calculations to assess quantitative relationships in data; and
2(D) evaluate experimental and engineering designs.
3(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories
3(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and
3(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.