CUSTOMIZED TOPOGRAPHIC MAPS AND RELIEF MODELS

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Level: Grades 4 - 6

Estimated Time Required

- 2 hours preparation
- 1 hour for classroom construction project
- 1 hour for field trip

Anticipated Learning Outcomes

- Students will learn the significance of topographic contours.
- Students will learn to use a topographic map to navigate.

Background

Understanding topography and its graphical representation on topographic maps is an important part of Earth science education. Topographic maps typically represent topography by the use of contour lines, lines that connect points having the same elevations. The concept of contour lines, however, is not easily grasped by beginning students at any level. One way to approach the teaching of this concept is by hands-on activities that utilize three-dimensional topographic maps (sometimes known as relief models) depicting topography.

There are a number of published descriptions of ways to devise topographic maps and relief models. Some are very simple, involving cutting out and stacking simple paper or cardboard shapes, but others are more complex, involving pieces of masonite board, clay, shoe boxes, and so on (see, for example, Braus, 1988, p.35-36; FOSS, 1990, Activity 4, Landforms Module; and Heller, 1970, p. 398-399). The project described here requires only simple materials and is intermediate in complexity.

Instructions are given for the preparation of customized topographic maps as well as three-dimensional maps (relief models) tailor-made for particular locales. This ensures that the map will be relevant to students. A map made for use by elementary school students in Cleveland, Ohio, is used as an example.

The instructor using the procedures outlined here should be familiar with topographic maps.
**Materials**

- A U.S. Geological Survey topographic map that includes an area of interest (for instance, an area including the school grounds). Topographic maps can be found at many large libraries and are also available from the U.S. Geological Survey (for more information, write USGS Map Sales, Box 25286, Denver, CO 80225, Earth Science Information Center, U.S. Geological Survey, 507 National Center, Reston, VA 22092. FAX (703) 648-5548) as well as many state geological surveys and commercial outlets.
- Customized topographic map (prepared by the teacher; procedures given below).
- Light cardboard, about the thickness of file folders. (It is easy to cut this weight of cardboard and is also a good way to recycle used file folders. Alternatively, foam boards, Styrofoam trays, etc. could be used.)
- Glue sticks

**Procedures for Instructor's Customized Topographic Map**

1. Use a photocopy machine to make an enlarged copy of the desired area of the topographic map. Seven and a half-minute topographic maps are made at a scale of 1 inch = 2,000 feet. I have found that it is desirable to enlarge a map so that a distance of 500 feet on the original topographic map equals at least one inch on the copy you are making. Thus, several increases in scale using the photocopy machine may be necessary. (Be sure to enlarge the scale bar each time you enlarge the map.)
2. Trace the desired features (topographic contours, streets, etc.) and the scale from the photocopy onto a sheet of tracing paper. Use marking pens with various point thicknesses. At least two different line widths are preferable; this will allow you, for instance, to differentiate topographic contours from roads. Simplify the map if necessary (it is not necessary to show everything on the original map). Add a north arrow. Duplicate the final map on paper so that each class member can have two copies. (See below.)
Procedures

1. Students should be introduced to maps in general and topographic maps in particular. It is important to discuss scale, direction, and topography. Depending on the level of the students, this may take several lessons. (See Engebrecth, 1978, 1979, for some ideas.)

2. Students should each be given two copies of the customized topographic map. They then can color in parts of one of the maps. Waterways, for instance, can be colored blue and streets can be colored gray.
3. A copy of the map can be used as a template for cutting pieces of light cardboard that will represent the elevation at various contour levels. This can be done individually by the students. Alternatively, you can cut out one set of cardboard pieces and trace them onto other pieces of cardboard. Students can then simply cut out the pieces that you have outlined. Students can also work in pairs or in small groups. It is nice to have a parent volunteer at this stage of the project.

4. Students should glue the cardboard layers in a stack as appropriate, using another copy of the map as a guide to placement (see below). The stack can then be glued onto the appropriate place on a copy of the customized topographic map. The entire assembly can be glued to a piece of cardboard, if desired, for extra support. Students then should mark the elevations on the various layers of the resultant relief model. They can also draw streets, etc., on the cardboard layers that cover up these features of the original map. Students can then color portions of the maps as appropriate. Bodies of water can be colored blue, streets can be colored gray, and so on.

5. Students can then take their maps and models on a field trip. Unless the students have drawn streets, etc., on their relief models, the customized topographic map should be used. During the field trip, students can find themselves on the map, locate places, and find their way from one place to another. The field trip is one of the most important phases of the project, as it allows the student to compare his or her map to the "real world." The teacher can ask students questions (such as, "What is the elevation of the point we are now at?") while on the field trip. Alternatively, worksheets can be devised to focus the students' attention.

Results and Discussions

It is difficult for students to visualize topography using a two-dimensional topographic map. A three-dimensional map (relief model) is better, but a three-dimensional map of familiar terrain is best, especially when used in conjunction with a field trip.
**Additional Activities**

This project can be used in conjunction with U.S. Geological Survey's "What Do Maps Show?" (1993). Related projects are described by Heller (1970) and by O'Connor and Shugrue (1973).

**Acknowledgements**

This project was originally designed for and tested by a Young Astronauts group, then led by Bob Schmidt, at Urban Community School. Urban Community School is located at the spot marked by the school symbol on the topographic map.

**Recommended Reading for Teachers**


FOSS (Full Option Science System), 1990, University of California, Berkeley, distributed by Encyclopedia Britannica.


U.S. GEOLOGICAL SURVEY, 1993, What Do Maps Show? (A teaching packet including a poster and four lessons - can be used "off-the-shelf" for upper elementary-junior high students. Lesson 4 - how to read a topographic map, is particularly relevant here.)