

Teaching About Earthquakes in an Elective Course

by Steven Boyar

Teacher, Scarsdale Public Schools

Another alternative to the perennial issue of where to fit new content into an already crowded curriculum is in an elective course. At Scarsdale High School we offer an elective course on "Earthquakes and Volcanoes."

The course is aimed at Juniors and Seniors who did not take Earth Science or who may have taken Earth Science and had a special interest in these topics. Although the greater part is spent on earthquakes, there are many opportunities to study them together because of the obvious parallel themes.

Below is a list of topics in the order they are studied for the earthquake component. Following is some additional information that may be helpful.

- Formation of the solar system and development of the earth's internal layering.
- Using seismic waves to understand the interior of the earth.
- Continental Drift and Plate Tectonic theory.
- Stress and Energy within the earth.
- Types of deformation.
- Types of faulting.
- Basics of earthquake occurrence.
- Worldwide distribution of earthquakes.
- Earthquakes and plate boundaries.
- Richter and Mercalli scales.
- Determining magnitude from a single seismogram.
- Types of seismographs and how they record earthquake waves.
- Location of epicenters from seismograms.
- Determining the origin time for an earthquake.
- Interpreting first motion from seismograms.
- Liquefaction.
- Case studies of historic earthquakes.
- Tsunamis.
- Predicting earthquakes: a) precursors; b) instruments; c) short vs. long term prediction.
- Damage caused by earthquakes.
- Minimizing damage.
- Safety measures.
- Potential seismic risk to New York State.

Instructional Materials

- Laboratory Materials - lots of lab work from many different sources.
- Slide sets and films.
- Magazine articles - have students regularly review articles.
- Computer program: Students manipulate a large data base from the USGS which includes a mapping program that allows students to research earthquakes and relate their distribution to plate boundaries. This was developed at Scarsdale.

Section 2 - Curricular Issues

Project:

Students are responsible for a research study of a specific geographic area (i.e., Japan, Indonesia, Iceland). They combine cultural-historical information with a computer-based study of seismicity and its relationship to plate boundaries. They also produce a detailed study of volcanic activity and relate it to seismicity.

Section 3

Disaster Preparedness

1. How and Why To Prepare Our Schools for an Earthquake Disaster
by Karl E. Naugle, Jr., Computer Coordinator, Dorchester School District, Summerville, South Carolina
2. Earthquake Disaster Preparedness Planning: What is It All About? Who is Responsible?
by Bret Breton, Safety Coordinator, Ventura County Schools, Ventura, California
3. Earthquake! This is Only a Test! How to Conduct a School Earthquake Exercise
by Pat Jocius, Administrative Specialist for the City of Cupertino, Cupertino, California
4. Urban Search and Rescue in Schools: A Disaster Affecting the Future of the Nation
by Jan Smith, President, Urban Search and Rescue, and Administrative Director for CMC Rescue, Inc., Santa Barbara, California.
5. School Preparedness Supplies and Student Emergency Comfort Kits
by Frances E. Winslow, Director, Office of Emergency Services, City of San Jose, California
6. Financing School Preparedness Supplies: The Pennies for Safety Project
by Terry Gabrielson, "Pennies for Safety" Project Chairperson, Blytheville, Arkansas
7. Unacceptable Risk: Earthquake Hazard Reduction in One California School District
by Arrietta Chakos, Facilities Grants Liaison, Berkeley Unified School District, and Sarah K. Nathe, Resource Coordinator, Bay Area Regional Earthquake Preparedness Projects, Oakland, California

Section 3 - Disaster Preparedness

Earthquakes have damaged schools. August 31, 1886, damage occurred at Charleston College in an earthquake that killed 60 residents of Charleston, South Carolina. March 10, 1933, in Long Beach, California, the John Muir School on Pacific Avenue and the wall of the dance hall building in Compton High School collapsed. October 31, 1935, the west wing of the new Helena High School collapsed in an earthquake in Helena, Montana; the collapsed part of the school had reinforced concrete frame, floors, and roof, and tile floors faced with brick. August 18, 1959, in Hebgen Lake, Montana, the decorative stone entryway was shaken down at the West Yellowstone Elementary School. Government Hill Elementary School was split in two during the Good Friday earthquake (March 27, 1964) in Anchorage, Alaska.

At 4:42 p.m. on Monday, May 2, 1983, a 6.5 magnitude earthquake struck Coalinga, California. Seconds later there was an aftershock of 5.0 on the Richter Scale. A report prepared after this earthquake by E. Robert Bulman for Charles S. Terrell, Jr., Superintendent of Schools for San Bernardino County, California, noted extensive nonstructural damage to the schools. About 1,000 fluorescent light bulbs fell from the fixtures and broke. Improperly installed T-bar ceilings and glued ceiling tiles fell. Water pipes in the basement broke, flooding the basement and stopping the electrical supply because all the switching mechanisms were damaged by water. In a second floor chemistry lab in the high school, bottles of sulfuric acid and other stored chemicals fell and broke. Acid burned through to the first floor. Because there was no electrical power to drive the ventilating system, poisonous fumes filled the building. Superintendent Terrell feels that death and serious injury would have resulted had school been in session. This damage could have been minimized had school personnel reviewed and remedied some of the potential hazards prior to this earthquake.

Children spend a significant portion of their day in schools. The school community needs to be well-prepared to meet school earthquake emergencies in order to protect the welfare of students and staff both during and after the ground shaking. Therefore, the development of an effective earthquake education program requires not only an understanding of the natural processes involved but also the type of dangers they pose to the school community. Students of all ages and ability levels must be able to take self-protective actions during an earthquake. Schools must have an emergency plan that includes earthquakes. Earthquake preparedness must be the responsibility of the entire school community, for it is the total school community which is at risk.