Using Earthquake Videotapes in the Classroom©

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Explorations in Earth Science

Introduction: Videotapes, if used properly, can be very effective teaching tools for study of earthquakes or other science topics. "Videos" are effective because: (1) they commonly contain scenes and action sequences that cannot be represented with other media (text, photographs, filmstrips, etc.), (2) videos allow extensive examination of a video-taped process or event through replay, slow motion, stop-action and pausing to discuss the action with the class or clarify a point, (3) videos often contain computer graphics or diagrams in action or 3-D sequences that accurately illustrate complex processes or events, (4) quality, expensive-to-produce videos are available to educators at low cost or by loan and can "transport" the classroom to exotic and unique places to observe scientific and natural events.

Suggestions: Following some simple suggestions (shown below) for use of videotapes in the classroom will enhance their effectiveness as a teaching tool.

(1) Be sure to preview the video so you know its content and can give an introduction to the class before viewing, and to prepare a "handout" to accompany the video.

(2) Be sure everyone can see and hear the video monitor.

(3) A remote control is highly recommended because it allows the teacher to sit in the classroom area (in front of the screen) with the class and control the tape (pause, repeat, slow-motion, fast-forward, etc.) for better emphasis of a significant sequence or to stop the tape for discussion or clarification.

(4) Usually, the time required to properly introduce, view, and discuss a videotape, complete an associated written activity/handout, and have a follow-up discussion is about 1-1/2 to 2 times the length of the tape itself.

(5) Long (40-60 min.) videos should be separated into two viewing times (days, class periods) to allow time for introduction and discussion.

(6) Showing only a short segment of a video can be effective (and takes much less time) if particular scenes are selected and an appropriate introduction provided so that the scenes are placed in context.

(7) A generally effective procedure consists of the following:

(a) The teacher should provide an introduction (written or oral) to the video discussing the background and context of the topics illustrated in the video and briefly previewing what will be seen and any particular sequences to watch for. The teacher can also suggest that the students write down questions or words that they don't understand during the video for subsequent discussion.

(b) The students should be provided with a handout with questions to answer, specific scenes to watch for and clarifications or definitions of specialized vocabulary.

(c) A "wrap-up" or discussion session after the video can provide a time to emphasize conclusions or main points, stimulate creative thinking resulting from the video scenes, answer questions, obtain student reaction and input, and discuss or grade any questions in the handout.

Some Recommended Earthquake Videos:

(information on earthquake videos can be found in Seismology-Resources for Teachers, http://web.ics.purdue.edu/~braile/edumod/seisres/seisresweb.htm):

NOVA series – Earthquake; Killer Quake; The Day the Earth Shook

Discovery Channel – Living with Violent Earth: We Live on Somewhat Shaky Ground; Alaska Earthquake

Earthquake II: You Can Survive!

Hidden Fury: The New Madrid Earthquake Zone

Surviving the Big One

Specific Topics in Selected Earthquake Videos:

(times of specific scenes, in minutes:seconds, are from the beginning of the program)

Seismographs – Nova series – Earthquake, ~11:50-12:40, ~19:15-20:15

Seismic Waves (animations) – Nova series – Earthquake, ~12:40-13:10; Discovery – Living With Violent Earth: We Live on Somewhat Shaky Ground, ~3:45-4:45

Earthquake Preparedness – Earthquake II: You Can Survive!, 22 minutes

Earthquake Shaking – Nova series – Killer Quake, ~1:40-2:20, ~18:30-19:30; Nova series – The Day the Earth Shook, ~5:45-6:45; National Geographic Explorer – When the Earth Quakes, ~1:45-2:45, ~24:30-25:30; The Learning Channel – Real History – Earth's Fury, ~0.00-1:15

Examples of Earthquake Damage – Discovery – Living with Violent Earth: We Live on Somewhat Shaky Ground, ~5:15-7:45; Nova series – Killer Quake, ~5:00-8:00, ~11:20-14:00; Nova series – The Day the Earth Shook, 55 minutes

Elastic Rebound, Cause of Earthquakes – Nova series – Killer Quake, ~19:00-22:30; Discovery – Earthquake Country, ~2:00-4:10

Plate Tectonics – Nova series – Earthquake, ~20:40-22:40; Continental Drift and Plate Tectonics, 20 minutes

New Madrid Earthquake Zone – Hidden Fury, 27 minutes

Example of Handout/Questions to Accompany Video:

Nova series - Earthquake! (1990, 55 min.)

(see below)

Handout to accompany:

NOVA - Earthquake! Videotape

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Introduction: The NOVA series videotape (55 min.) *Earthquake!* was produced in 1990 after the October 1989 Loma Prieta earthquake (magnitude 7) which caused significant damage and loss of life in the Santa Cruz, San Francisco, and Oakland areas of central California. The videotape begins with scenes of ground shaking, damage and people's reactions to the earthquake. Early earthquake studies around the world and in California (following the famous 1906 San Francisco earthquake) are documented to display the development of current understanding of the earthquake process and expected ground and building response and to illustrate seismological monitoring of earthquakes using seismographs. Key concepts of earthquake magnitude and the causes of earthquakes due to plate motions (plate tectonics) are also illustrated. A central theme of the videotape is the investigation of the possibility of earthquake prediction as a scientific development and as a means to reduce the risk of future earthquakes. The distinction between two approaches, forecasts based on well-defined probabilistic estimates which are aided by accurate historical seismicity data and paleoseismology investigations, and predictions based on the capability of identifying long-term or short-term precursory phenomena before a major earthquake, are illustrated.

While viewing the videotape, note the following key words or concepts. If the videotape explanation or your understanding of the word or concept is unclear after viewing, please ask for discussion or clarification.

Key Words and Concepts:

Earthquake Prediction and Forecast
Seismograph
Inertia
Magnitude
Paleoseismology

Questions and Observations (in order of viewing on videotape): These questions are appropriate for a "quiz" or study guide during viewing of the video or questions for class or small group discussion after viewing the video**:**

1. In the sequences showing earthquake shaking and damage during the 1989 Loma Prieta earthquake:

   (a) What earthquake effects did you observe?

   (b) How would you describe the response of people during the shaking?

2. Was the Loma Prieta earthquake forecast or predicted?

3. What precursory phenomena have been observed before some large earthquakes?

4. Note the computer graphic simulation of P (compressional) and S (shear) seismic wave propagation. What are the differences between P and S wave motion? What are the similarities?

5. How can the location of earthquakes be determined?

6. What factors increased the destruction during and after the 1906 San Francisco earthquake?

7. Note G.K. Gilbert's description of the earthquake process inferred from observations of the 1906 earthquake. Although his explanation pre-dates plate tectonics, the elastic rebound concept is consistent with contemporary understanding of earthquake mechanics and plate interactions. Briefly describe the elastic rebound process that explains how the sudden and rapid motion along a fault plane during an earthquake can be caused by very slow movement of the Earth's plates.

8. What information about an earthquake can be determined from study of seismograms?

9. What are the three types of plate boundaries that are associated with earthquake activity?

10. The second half of the video emphasizes earthquake prediction. Note that the Chinese have had both successful and unsuccessful experiences with earthquake prediction.

11. Why are paleoseismology data useful in forecasting earthquakes?

12. What areas of central California are forecast to have significant earthquake hazard?

An additional activity related to the Loma Prieta earthquake and the earthquake activity in the San Francisco bay area is "San Francisco Bay Area Earthquakes." Additional information on earthquake hazards in the Bay Area can be found in the USGS fact sheets (pdf [read using Adobe Acrobat Reader available for free download at www.adobe.com] files are available to print the fact sheets; the fact sheets are most effective when printed in color):

> Progress Toward a Safer Future Since the 1989 Loma Prieta Earthquake, Fact Sheet 151-99, http://geopubs.wr.usgs.gov/fact-sheet/fs151-99/
>
> Major Quake Likely to Strike Between 2000 and 2030, Fact Sheet 152-99, http://geopubs.wr.usgs.gov/fact-sheet/fs152-99/
>
> When Will the Next Great Quake Strike Northern California?, http://quake.wr.usgs.gov/QUAKES/Fact Sheets/When/