Title: Volcanoes and Google Earth
Author: Daniel Wexler
Grade Level: 9-12
Rationale: The study of volcanoes provides students with insight into the dynamic nature of the Earth's structure as manifested in crustal movements that give rise to earthquakes and volcanic eruptions. The use of Google Earth as an analytical tool provides students with a means to readily visualize geologic phenomena and their geographic contexts. In addition, students will examine the effects of major eruptions on climate in the context of human effects.
Materials: Computers with internet access and installed Google Earth.
Student Learning Objectives:
1. What are the names of the different classes of volcanoes?
2. What are the characteristics that determine each classification?
3. What causes volcanoes to erupt?
4. What determines the geographic location of a volcano?
5. What are the immediate local and global effects of eruptions and their causes?
6. What are the long-term local and global effects of eruptions and their causes?
7. How do scientists predict when a volcano is about to erupt?

Procedure:
A. Prior to starting this lesson, students should have the following knowledge and skills:
1. Familiarity with searching for information on the internet.
2. Familiarity with using the Google Earth interface, working with kml/kmz files, inserting images and text into placemarks.
3. Familiarity with basic HTML language structure and use of tags.
4. A basic understanding of the Earth's structure and its dynamic nature, especially plate tectonics.
5. A basic knowledge of the structure of volcanoes and their different classifications.
B. Randomly assign GPS coordinates for a single volcano to each student or student group.
C. Students use Google Earth and relevant websites (USGS, etc.) to gather information pertaining to the questions posed in the lesson handout.
D. Students will share their files with the class and individually compile all shared kmz files to produce a master file.
E. Students will answer questions arising from observations made using their master file in Google Earth.
F. Students will make predictions using historical and current geographic data as well as their understanding of social and environmental factors.
G. Students will present their results by guiding the class through their Google Earth kmz file and discussing relevant content.
H. Extensions: The teacher will display Google Earth kmz files illustrating continental drift as well as the relationship between plate boundary locations and volcanic activity.

Resources: Tutorial and Reference
USGS: http://www.usgs.gov/
Geology: http://geology.com/
Volcanoes: http://www.volcanoes.com/
Global Volcanism Program: http://www.volcano.si.edu/
Wisconsin Model Academic Science Content Standards for Grade 12:

Content Standard A (Science Connections): Students in Wisconsin will understand that there are unifying themes: systems, order, organization, and interactions; evidence, models, and explanations; constancy, change, and measurement; evolution, equilibrium, and energy; form and function among scientific disciplines.

Content Standard B (Nature of Science): Students in Wisconsin will understand that science is ongoing and inventive, and that scientific understandings have changed over time as new evidence is found.

Content Standard C - Science Inquiry: Content Standard: Students in Wisconsin will investigate questions using scientific methods and tools, revise their personal understanding to accommodate knowledge, and communicate these understandings to others.

Content Standard F - Life and Environmental Science: Students in Wisconsin will demonstrate an understanding of the characteristics and structures of living things, the processes of life, and how living things interact with one another and their environment.

Content Standard G - Science Applications: Students in Wisconsin will demonstrate an understanding of the relationship between science and technology and the ways in which that relationship influences human activities.

Content Standard H: Students in Wisconsin will demonstrate an understanding of the relationship between science and technology and the ways in which that relationship influences human activities.

Wisconsin Model Academic Science Performance Standards for Grade 12:

Performance Standard A: Science Connections
A.12.6 Identify and, using evidence learned or discovered, replace inaccurate personal models and explanations of science-related events
A.12.7 Re-examine the evidence and reasoning that led to conclusions drawn from investigations, using the science themes

Performance Standard B: Nature of Science
B.12.5 Explain how science is based on assumptions about the natural world and themes that describe the natural world

Performance Standard D: Physical Science
D.12.12 Using the science themes* and knowledge of chemical, physical, atomic, and nuclear interactions*, explain* changes in materials, living things, earth's features, and stars

Performance Standard E: Earth and Space Science
E.12.2 Analyze* the geochemical and physical cycles of the earth and use them to describe* movements of matter

Performance Standard F: Life and Environmental Science
F.12.8 Using the science themes, infer changes in ecosystems prompted by the introduction of new species, environmental conditions, chemicals, and air, water, or earth pollution

Performance Standard G: Science Applications
G.12.2 Design, build, evaluate, and revise models and explanations related to the earth and space, life and environmental, and physical sciences

Performance Standard H: Science in Personal and Social Perspectives
H.12.3 Show how policy decisions in science depend on social values, ethics, beliefs, and time-frames as well as considerations of science and technology