Three-dimensional cooperative modeling

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Michigan standards:

Benchmark SCI.II.1.HS.2
Describe some general limitations of scientific knowledge.

Benchmark SCI.II.1.HS.3
Show how common themes of science, mathematics, and technology apply in real-world contexts.

Benchmark SCI.II.1.HS.6
Develop an awareness of and sensitivity to the natural world.

Benchmark SCI.I.1.HS.5
Discuss topics in groups by making clear presentations, restating or summarizing what others have said, asking for clarification or elaboration, taking alternative perspectives, and defending a position.

Benchmark SCI.I.2.HS.2
Use plate tectonics theory to explain features of the Earth's surface and geological phenomena and describe evidence for plate tectonics theory.

Introduction:

The basic premise behind this lesson plan is to integrate Teachers Earth Science Institute information (offered by Michigan Tech) and ideas into the classroom. The "exploration for ore bodies and three-dimensional visualization" lesson will serve as a model for the lesson plan. The twists offered are a tangible self-evaluation and removal from the assessment.

Each time block of this plan is about 45 minutes in duration.

Background:

Geologists use core drilling to gain an understanding for what is beneath the earth's surface. The rock core drills use diamond bits to cut small holes to enable geologists to see rock layer patterns. Rock samples are drilled and drawn from the ground in three-foot sections. Geologists then identify the rocks and the thickness of each layer is recorded for future use.

Block 1:

Question session: Students are shown a plain brown box and asked how they would determine what is inside the box, without opening it. The students are then shown a 3-D model of a land area and asked how they could figure out what the rock layers look like below the topography. Hopefully the students will see that the best way to learn what is present below the surface is to drill into the ground and record the type of material that the drill brings to the surface.

The land model will be divided into 10 slices with each slice, or plate containing 10 "drill cores." Dill cores are unevenly distributed along the plate line. These cores will be color coded to indicate where each different rock type resides in the plate.

Show the class drill core examples. Demonstrate to the students how to record drill core information. Explain what rock type each different layer on the drill core represents.

Divide the class into smaller groups (2-4 students) and assign each group a plate area of the model. One member from each "drilling team" will come to the model and remove the 10 cores from their plate.

Have the students measure and interpret the drill core information for their plate and record it in their corresponding data table.

Block 2:

Give students an article about blogging and distance communication in the sciences and engineering. Discuss the benefits and drawbacks of distance communications. Introduce them to blogging and demonstrate how to conduct a discussion over a distance.

(Investigate the possibility of conducting a real-time discussion between the cooperating classrooms with both groups participating in the discussion simultaneously)

Each group will log onto novemberlearning.com and send their dill core information to the cooperative class (Clio HS or Madison HS). This would simulate a contracted drilling operation that reports their drilling results to geologists at the headquarters of a mining company.

Block 3:

Draw cross-sections from drill core data sent from the cooperating school. The dill core information will be graphed on letter sized (8 ½ x 11) graph paper.

The graphs created by the "geologists" will be scanned and sent back the cooperating school from where the dill core information originated.

Block 4:

The "graphic artists" then transfer the graphs from paper to plexiglass sheets. Different colors will be used for different rock units. The surface and reference lines will be provided on the plexiglass sheet.

Plexiglass models definition- cross sections interpreted from dill core are drawn on plexiglass. A series of these cross-sections shows the orientation of the rock layers in three dimensions.

Assessment:

After completion of the plexiglass model by each class, the teacher will reveal the interior of the model to the class. After examining the original model, students will compare the original to the model that their class created. Each student will be asked to write an essay describing what they think happened to contribute to any discrepancies between the two models, and also what they see helped them to create a model that accurately represented the original. What difficulties occurred in communicating their data between the two classes? What was their favorite part about the assignment? What was their least favorite part? What aspect of the assignment would they most likely use in their other subjects/life outside of school?

Possible Extension Benchmarks:

Benchmark SCI.II.1.HS.5
Explain the social and economic advantages and risks of new technology.

Benchmark SCI.V.1.HS.1
Explain the surface features of the Great Lakes region using Ice Age theory.

Benchmark SCI.V.1.HS.2
Use the plate tectonics theory to explain features of the earth's surface and geological phenomena and describe evidence for the plate tectonics theory.

Benchmark SCI.V.1.HS.3
Explain how common objects are made from earth materials and why earth materials are conserved and recycled.

Benchmark SCI.V.1.HS.4
Evaluate alternative long range plans for resource use and by-product disposal in terms of environmental and economic impact.