ED43E-02

Teaching and Learning Tectonics with Web GIS

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Environmental Literacy and Inquiry
http://www.ei.lehigh.edu/eli

DR K-12 Award 1118677
Curriculum Design Approach for Geospatial Learning

- Curriculum framework
- Design principles
- Multi-step instructional model for the development of inquiry learning activities with spatially-enabled learning technologies
- Educative materials to support teacher enactment
Education Research Questions

- To what extent does the design model and Web GIS improve middle school learners’ understandings of Tectonic concepts and processes?
- How does design model and Web GIS enable spatial and geographical thinking and reasoning skills?
- What factors account for the variance in students’ geospatial thinking and reasoning after the curriculum enactment period?
- How can GIT-embedded curriculum materials be effectively designed to support teachers’ adoption and pedagogical use of Web GIS?
Project Features

- Tectonics investigations for curriculum enhancement
- Javascript Web GIS to be platform independent (i.e. tablets, laptops, cellphones)
- Interface design and customized data display
- Visualizations and tool features designed to enable spatial thinking
- Content and pedagogical supports for teachers to implement geospatial learning investigations
Research Methods

• Pilot testing and field testing in an urban school district (2 schools, 4 teachers, 12 classrooms)

• Tectonics content knowledge measures

• Spatial thinking and reasoning measures

• Teacher implementation practice to assess fidelity of implementation and curriculum enactment—adherence to geospatial learning design model

• Classroom observations

• Post-implementation survey to assess pedagogical effectiveness of the educative curriculum materials
Tectonics is a series of geospatial investigations designed to augment existing middle school Earth science curriculum. Students use Web GIS to investigate important tectonics concepts. The investigations include scientific practices, crosscutting concepts, and core ideas from the National Research Council (2012) Framework for K-12 Science Education.

The materials are best used with the Firefox or Google Chrome Web browser. This material is based upon work supported by the National Science Foundation (DRL-1118677).
Where’s the nearest hazard to my location?

from Investigation 1
Where’s the nearest hazard to my location?

Custom GIS For Each Investigation
How does thermal energy move around in the Earth?
Continental Boundaries
Ocean Spreading

Transform fault

Fracture zone

Fracture zone
What happened when plates converge?
Subduction zone profiles

O\O (Atka Island)

Pacific Plate (Ocean)
North American Plate (Ocean)

O\C (Kodiak Island)

Pacific Plate (Ocean)
North American Plate (Crust)

Units in kilometers (+) above or (-) below Mean Sea Level
Results

• High fidelity of implementation
  Adherence to the events in the instructional model

• High student engagement

• Ease of use for urban middle school teachers and students

• Assessments are reliable instruments

• Significant performance enhancements
  Tectonics content and Geospatial thinking and reasoning
Questions or Comments?

http://www.ei.lehigh.edu/eli/tectonics

To access assessments:
Login: eliteacher
Password: 87dja92
Design Principles

1. Design curriculum materials to align with the demand of classroom contexts.
2. Design activities to apply to diverse contexts.
3. Use motivating entry points to engage learners.
4. Provide personally relevant and meaningful examples.
5. Promote spatial thinking skills with easy to use geospatial learning technologies.
6. Design image representations that illustrate visual aspects of scientific knowledge.
7. Develop curriculum materials to better accommodate the learning needs of diverse students.
8. Scaffold students to explain their ideas.
9. Use icons that portray the real-world concept.
Elicit prior understandings of lesson concepts.

Present authentic task.

Model task.

Provide worked example.

Ask learners to perform task.

Scaffold task.

Ask learners additional questions to elaborate task.

Review activity concepts.