Integrating Web GIS in Earth Science Curriculum to Investigate Tectonics

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Environmental Literacy and Inquiry
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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

NGSS Disciplinary Core Ideas (Achieve, Inc., 2013)
ESS1.C: The History of Planet Earth
ESS2.A: Earth’s Materials and Systems
ESS2.B: Plate Tectonics and Large-Scale System Interactions
ESS3.A: Natural Resources
ESS3.B: Natural Hazards
ESS3.C: Human Impacts on Earth Systems
ESS3.D: Global Climate Change

K-12 Framework Core Ideas (NRC, 2011)

- Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and weathering structures to provide evidence of the past plate motions.
- Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
- Apply scientific principles to design a method for monitoring and mitigating a human impact on the environment.
- Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.
Research-based Curriculum

- 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 educational curriculum materials

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What happens when plates diverge?

Half Spreading Rate

Continental Boundaries
Investigating the San Andreas Fault Zone

What happens when plates collide?

Results

- Significant student learning gains
  Tectonics content and geospatial thinking and reasoning skills
- High student engagement
- Ease of use for urban middle school teachers and students
- Well developed teacher support materials
- High fidelity of implementation in classrooms
Questions or Comments?
http://www.ei.lehigh.edu/eli/tectonics

To access assessments:
  Login: eliteacher
  Password: 87dja92