# DESIGNING LEARNING ACTIVITIES TO TEACH "SPATIALLY" WITH WEB GIS

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As part of a larger science education and urban school reform initiative to enhance the teaching and learning of Earth and environmental science, we developed an energy resources curriculum and are developing a series of tectonics investigations that use Web GIS to expand spatial thinking and reasoning skills. The web GIS includes advanced visualization and geospatial analysis capabilities that can be hosted on any ArcGIS Server. We are investigating how Web GIS can best be used to promote both spatial thinking and earth science learning goals, analyzing to what extent educative curriculum materials as a form of embedded professional development can prepare teachers to implement geospatial science pedagogical approaches to teaching, and documenting the impacts in terms of student learning outcomes. The curricular materials were developed using the Understanding by Design (Wiggins and McTighe 2005) instructional design process and a design framework that includes supports for curriculum adaptation. Activities are enhanced through a design partnership that includes science educators, scientists, instructional designers, and classroom teachers. National and state standards are used as guidelines for content in addition to the science inquiry and spatial thinking skills that schools must focus on. The learning activities address published misconceptions and knowledge deficits. The *Energy* curriculum incorporates Web GIS to foster student understandings of the world's energy resources, their use, environmental impacts, and contemporary sustainable energy resources. In the *Energy* culminating activity, students develop an energy policy for a fictitious island nation named Navitas (Latin for energy) for which students are tasked with creating a viable energy policy to meet the needs of its society. In the *Tectonics* activities, processes at divergent, convergent, and transform plate boundaries are explored using earthquake epicenter, DEM topography/bathymetry, volcano distribution, heat flow, free air gravity and magnetic anomalies, GPS velocities, and crustal age GIS data layers of North America. The coverages allow student investigations of plate boundaries and a "Tectonics and Me" activity explores student centered geologic hazard assessment.