Advancing STEM Education with GIS

By Tom Baker, PhD, Esri Education Manager

Science, technology, engineering, and math (STEM) education provides a multidisciplinary approach to improving education, the workforce, and national competitiveness. President Barack Obama noted that "Strengthening STEM education is vital to preparing our students to compete in the twenty-first century economy, and we need to recruit and train math and science teachers to support our nation’s students" (White House press release, September 27, 2010).

GIS technology can engage several critical elements in STEM curriculum and instruction. GIS tools and techniques lead to understanding cross-disciplinary phenomena and solving problems rooted in academic and real-world concepts. People use GIS to make maps, analyze data, and decide on best solutions. From a curricular perspective, GIS allows us to study climate change, design cities, inventory geologic samples, plan ecological growth models, catalog archaeological sites, and participate in countless other activities. GIS and the related geospatial technologies of Global Positioning Systems and remote sensing can be used to simultaneously engage students in STEM-related courses.

Instructionally, GIS is also well suited to driving problem-based learning (PBL), an approach to classroom inquiry commonly used in the STEM classroom. PBL is guided by a question, with students collecting data and making analytical conclusions. The National Science Education Standards indicates that PBL is an instructional framework best suited to support deep, meaningful learning.

GIS allows students to collect and visualize authoritative data about the question of interest, adding their own data to the map before performing a wide range of analyses on the data in question. GIS problems are steeped in both critical thinking and spatial thinking elements, motivating learners as they learn workforce ready skills.

To support the ever growing interest in GIS and STEM from teachers, researchers, and administrators, Esri has released a new (free) e-book, Advancing STEM Education with GIS, that addresses the multifaceted support GIS offers STEM classrooms. The e-book is filled with rich case studies of STEM in formal and informal environments. The power of STEM collaborations and partnerships and ties to career and work force development is also a central theme of the volume. The e-book outlines three beneficial tracks for student learning in STEM by integrating GIS technology:

- Improved declarative knowledge
- Improved procedural knowledge (e.g., critical thinking, problem solving, spatial reasoning)
- Twenty-first century career skills development

I hope that you take the opportunity to examine this new book and learn how teachers throughout the world are using GIS to enhance their science and technology courses.

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