

Three Converging Global Trends Provide Opportunities for GIS as a Critical Twenty-first-Century Educational Tool

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Three converging global trends provide great opportunities for GIS as a tool and as a perspective for use at all levels of education. First, our world faces complex **challenges** that are global in nature but also are increasingly affecting our everyday lives. Not a day goes by without seismic and weather-related disasters affecting communities to entire regions. Changes in population demographics are issues that impact politics and economics at local and global scales. Sustainable energy supplies are fundamental to the use of technology in the twenty-first century and are linked to raising standards of living and educational attainment. Epidemics sometimes impact the entire planet in significant ways. Sustaining agriculture and fisheries, transportation of food and other products, and water quality and quantity are fundamental to our very existence. Political instability and violence destroy property and displace whole populations. These challenges have long been some of the fundamental issues that scientists and GIS practitioners studied. Yet in the past decade, these challenges have become part of the everyday public consciousness. Many themes driving spatial analysis have become topics of everyday conversation and have fostered a heightened awareness of issues of location.



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At the same time, the general public has never before used as many geographic **tools** as it is using today. I remember being thrilled during the 1980s while I was employed by the US Census Bureau because I was able to look at aerial photographs, sometimes for hours each day! Contrast that with today: How many maps and satellite images were viewed by the general public in the span of time you have been reading this article? Hundreds of millions? Geographic tools, maps, and spatial data are not only available instantly on the web; they can also be accessed, downloaded, streamed, embedded, changed, reformatted, and retransmitted, on devices from smartphones to tablets to laptops, in the field, in vehicles, in research labs, in airports, in classrooms, and just about everywhere humans happen to be. These digital maps are used in newscasts, podcasts, web pages, videos, news feeds, and in many other twenty-first century media. Thus, the public has become extremely conscious of the value of maps in their everyday lives.

At the same time, we are rapidly moving to an era where just about everything around us is becoming **geoenabled**. From smartphones to tablet and laptop computers, from webcams recording traffic or bird counts to whether parking lots are empty or full, from earth-imaging satellites orbiting above to sensors on the earth below sensing water quality and current weather, all these sensors and devices transmit a latitude-longitude signal, enabled by the coupling of Global Positioning Systems (GPS), smartphone towers, and Wi-Fi transmitters. As geoenabling extends to thermostats, light switches, and appliances in our very own homes, it fosters "the Internet of things" (Wasik 2013) and, it is hoped, an "overall smart city framework and architecture" (Al-Hader and Rodzi 2009).

The largest part of this sensor network is the general public. Not only is the public using maps, but it is voluntarily and involuntarily providing information about location through the use of cloud-based smartphone and web browser applications. Information from smartphones and web browsing sessions is being fed to cloud-based services that offer to make life more efficient, comfortable, and interesting. Examples include connecting with and encouraging other people who are seeking to remain true to their exercise goals with the same fitness app, recommending products that match a person's purchasing history, and sending individuals' current speed and location to a regional real-time traffic map so that motorists can avoid snarls. People—a network over 7 billion strong—provide information about the planet as we have never seen before. Together, this sensor network and the geotechnologies that enable it will, "evolve into a kind of nervous system for our planet" (Dangermond 2002) analogous to how the human nervous system works to regulate the operation of our own bodies.



Three trends offer the educator compelling new opportunities to use GIS and also make a strong case for why the tools and the spatial perspective are important.

I believe these three trends present great opportunity not only to advocate the use of geotechnologies in education but also for the promotion of GIS as an essential twenty-first-century subject. Why? First, twenty-first-century challenges all occur somewhere, at multiple scales, with specific spatial distributions, patterns, and linkages and with a temporal component. Thus, they can be better understood using the geographic perspective—the "whys of where"—and with GIS. GIS enables us to

make sense of complex local-to-global issues. If we do not teach skills using GIS and the spatial perspective, how can we hope to solve these problems? Second, the common use of geographic tools and data paves a way of learning from the familiarity with visualization to spatial analysis. With the heightened awareness comes an enormous opportunity for using these tools in education. Third, geoenabled everyday devices means that there is no shortage of geographic data with which to work. The challenge is in sorting out the trivial from the important and to foster critical thinking. As we move forward into what I believe will be the most exciting period we have ever seen in GIS in education, I also believe we cannot be complacent. There is just too much at stake.

References

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