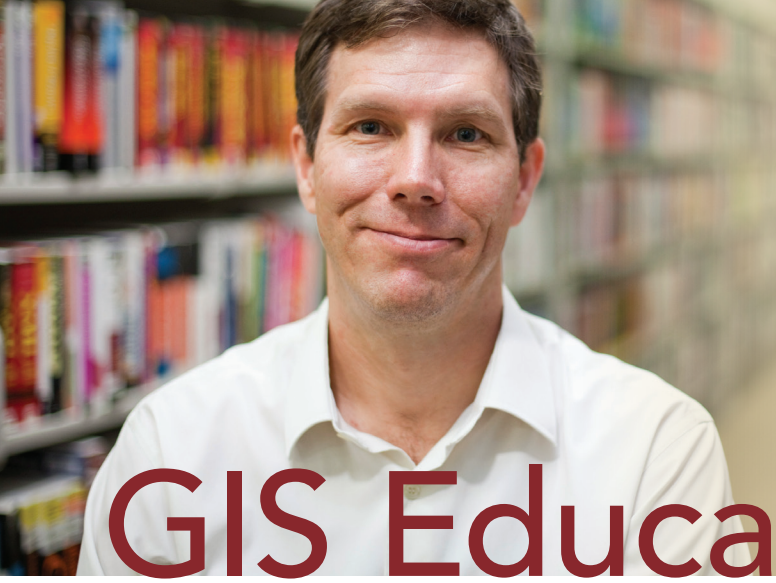

"The successful progression from globe spinning to geographic critical thinking is one of our community's most important challenges."

GIS Education Today

An interview with Michael Gould

Editor's Note: Michael Gould is Esri's director of education for industry solutions. He earned his doctorate in geography from the National Center for Geographic Information and Analysis (NCGIA) at the University at Buffalo, New York. Before joining Esri, he was an interdisciplinary professor of information systems and cocreator of an Erasmus Mundus-funded geospatial technologies master's program at Universitat Jaume I, Castellón, Spain. Gould's research interests include spatial data infrastructures (SDI), standards-based interoperability, and geospatial web services. He spoke with Esri writer Jim Baumann about the challenges and opportunities facing GIS educators.

Baumann: What are the primary challenges confronting GIS educators today?

Gould: One of the major challenges for all educators—not only GIS educators, unfortunately—is that education budgets are being cut to compensate for national and regional financial problems, which they were not responsible for causing. The trend of being asked to do more with less cannot continue, and we must stand up to help our educators defend the principle that education is our collective future.

Regarding GIS, one of the major challenges continues to be the difficulty in explaining to administrators the value of GIS, both for improving critical thinking in the classroom and for administrative use to save money and improve services such as transportation and safety and even for fund-raising. Educators who describe GIS as valuable only for mapmaking will continue to be challenged, so it is incumbent upon them to shift to these deeper justifications.

Baumann: How can universities best expose their students to the advances being made today in GIS technology with limited funding and increased teaching loads during this recessionary period?

Gould: Universities need to understand the entire value proposition of GIS: an investment made not only for a few students to learn in the classroom (and get jobs later) but also so that many different departments might stimulate their research activities. GIS also has valuable administrative uses. GIS software that is hidden away in a single academic department's classroom will not meet its potential return on investment [ROI]. This value proposition is not really affected by the overall economic climate any more than is the value of a microscope to biology students. One of the best ways for universities to maximize ROI is to engage in a university site license, which provides access to unlimited software, including server products, by all departments for educational and administrative use. The site license brings down the cost per seat of software, and this makes it easier for departments that are not traditionally geoenabled, such as computer science, to experiment with GIS in their curricula and research projects.

Even at universities that have not yet exploited site licenses, students now have more options than ever to program applications using GIS components that are freely available, either via open source projects or the free tools offered by commercial vendors. Over the past two years, Esri has published a broad suite of free application programming interfaces (APIs); software development kits (SDKs); clients such as ArcGIS Explorer; and ArcGIS Online, a cloud-based environment for publishing and discovering a myriad of geocontent.

Baumann: Can you discuss the importance of GIS education in the development of critical thinking skills?

Gould: Simply put, GIS is a critical-thinking platform. The platform's tools help promote what educational experts call constructivist learning: learning by modeling and building. Rather than merely reading about how a city is planned and managed, why not model and build a virtual city using a database and graphic tools? What are the city's essential components, and how do they interact with each other? Then, which fixes or updates can help improve the performance, sustainability, or livability of the city?

GIS supports a long list of what-if questions about our world—permitting students to go beyond spinning the globe or zooming in to see their house—to be able to dig deeper, make quantitative

comparisons, and propose solutions. One of the few things that educators, politicians, and businesspeople seem to agree on is that students need to learn to become better critical thinkers. Current tendencies in many countries toward teaching to standardized exams put us at risk of sliding toward the educational equivalent of fast food, instead of toward education providing the critical thinking society demands. A central challenge for the entire GIS field is to demonstrate how GIS technology, like spreadsheets and general database management systems, can be and is being used as effective critical-thinking platforms across the entire campus, across the entire curriculum.

Baumann: What will it take for universities in general to implement a GIS curriculum or classes for a wider range of students (those in disciplines outside the traditional geography and the earth sciences); that is, how do you broaden the awareness of the benefits of using GIS to faculty and students outside the traditional GIS disciplines?

Gould: One of the keys is to stop treating GIS as a property and specialty of only the geographer. Nearly all fields of study work in and within spatial constraints, and all students could use a dose of the kind of critical thinking that a well-prepared GIS lab exercise can provide. One way to help them do so is to more widely promote the open studio medium of instruction, such as that used habitually by architecture students. Critical thinking and problem solving go hand in hand with group project work.

Baumann: Which nontraditional disciplines would be the most appropriate to implement a GIS track?

Gould: Beyond the traditional fields of geography, planning, and geosciences, there are several disciplines, such as business, public health, environmental science, and history, in which we have seen interesting applications of GIS technology and spatial analysis. And more computer science departments should experiment with geospatial algorithms, data models, and applications, but of course, this depends on individual researchers catching the virus.

Baumann: Are there major differences in GIS education between the United States and Europe?

Gould: The similarity lies in the more or less common curriculum being taught on the two continents. The main difference lies in the stronger job market, despite the economic downturn, in the United States, which leads to a sense of optimism that graduates of GIS programs will find a job as long as they are able to move to where the employment is. There are perhaps 2,000 open positions currently just in the Washington, D.C.; Colorado; and California regions. This strong demand is partly due to the comprehension among government and business leaders that GIS is not just for geographers.

Another related difference is the greater degree of competitiveness among US universities to attract the most capable, financially independent students from around the world. Outside of perhaps the UK and Germany, I do not see much of this competition in Europe. Finally, many more US universities have software site (or campus-wide) licenses, allowing wider dissemination of GIS across the campus, whereas European universities are more likely to have just a few individual laboratories with limited GIS licenses available to students.

On both continents, many professors are limited users of open source software, but they also realize that teaching commercial software better prepares students for professional employment at organizations that are regular users of similar software. Speaking of employment, on both continents, professors need to pay greater attention to enterprise workflows, which means less focus on desktop GIS and more on server, mobile, and web solutions.

Baumann: How do Esri's education efforts affect its overall commercial role and development/research activities?

Gould: Esri's history began with close ties to universities. For example, the University of California, Riverside, hosted some of the early Esri GIS software on its mainframe. Some of the earliest Esri users were the University at Buffalo (then SUNY-Buffalo) and the University of South Carolina. The formal Esri education program started in the early 1990s, and now we have nine specialists working with education users in the United States. There are many other specialists working at Esri distributors around the world.

Certainly one of the main reasons Esri has such a large and wide user base is in part due to the fact that these users learned Esri software at universities and now, increasingly, at secondary schools and through informal education programs also. As far as current research and development, the universities play four fundamental roles: Esri developers read their scholarly papers and follow their output at conferences; Esri hires many of the best GIS program graduates; Esri has consulting agreements with several of the best-known academic experts in the GIS field; and the Esri Development Center (EDC) program provides special recognition and increased contact with developers to a small set of university research groups that work in teaching GIS software development.

Recently, Esri began hosting a series of geographic information science [i.e., GIScience] events at its headquarters in Redlands, California, aimed at bringing together experts in cutting-edge fields such as space-time modeling [at an event held February 2010] and volunteered geographic information [at another event held in February 2011] as well as smaller specialist meetings on topics of mutual research and development interest.

I believe that the renewed interest in maps and mapping that has been inspired by geovisualization software such as Google Earth, Bing Maps, and ArcGIS Explorer will help drive an expanded use of fully functional GIS on campus, in both classroom and administrative settings. The successful progression from globe spinning to geographic critical thinking is one of our community's most important challenges.