GIS in Higher Education, 2012 — Metro State College — April 6, 2012 — Denver, Colorado

Panel on

GIS in Higher Education: Simultaneously Trivializing and Complicating GIS

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Panelists
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Questions Considered: The discussion focuses on issues, opportunities, concerns, considerations and future directions GIS Education. Included below are comments made by Joe Berry, **jberry@innovativegis.com**.

This document is posted at **www.innovativegis.com/basis/present/GISHigherEd2012/Panel_JKBresponses.pdf**

(Berry lead). **Is there an inherent responsibility for the GIS community in higher education to further general awareness and understanding of geotechnology (RS, GIS, GPS) across campus? If so, in what ways can we provide opportunities for non-GIS faculty and students to learn about GIS capabilities as a "technology tool" and as an "analysis tool" considering interdisciplinary education constraints and considerations (e.g., time, budget, organization, promotion/career, etc)?**

Any new or rapidly evolving technology has an inherent responsibility to further general awareness. In the current euphoria of GIS as a "technical tool," the marketplace is defining not only what GIS is, but its future. To some degree, higher education in GIS on many campuses seems to have abdicated a primary leadership role and tend to have taken a "vocational role" focusing on GIS-specialists training.

To most folks on campus it is "*simply a set of highly useful apps on their smart phone that can direct them to the cheapest gas for tomorrow's ski trip and locate the nearest pizza pub when they arrive. Or it is a Google fly-by of the beaches around Cancun. Or a means to screen grab a map for a paper on community-based conservation of howler monkeys in Belize*"—in a sense trivializing GIS.

To a smaller contingent on campus, it is career path that requires mastery of the "*mechanics, procedures and buttons of extremely complex commercial software systems for acquiring, storage, processing, and display spatial information*"—in a sense complicating GIS.

Both perspectives are valid. However neither fully grasps the radical nature of the digital map and how it can drastically change how we perceive and infuse spatial information and reasoning into science, policy formation and decision-making—in essence, how we can "think with maps." To achieve our billing as one of the three mega-technologies of the 21st century (Bio-, Nano- and Geotechnology) we need to 1) insure that spatial reasoning skills are taught K12 through higher education, 2) instill the idea that modern digital maps are "*numbers first, pictures later*" and 3) these organized sets of numbers support quantitative analysis.

I am increasingly struck by the thought that we are miss-communicating GIS's potential, particularly with the STEM communities on campus who ought to be excited about infusing spatial considerations into their science. The result is that "innovation and creativity in spatial problem solving are being held hostage to a trivial mindset of maps as pictures, an unsettling feeling that GIS software is too complex, and a persistent legacy of a non-spatial mathematics that presupposes spatial data can be collapsed to a single central-tendency value that ignores any spatial variability inherent in the data."

A possible way to address this miss-communication is to take a *Spatial*STEM perspective (see handout). The SpatialSTEM approach (**www.innovativegis.com/basis/Papers/Other/SpatialSTEM/SpatialSTEM_case.pdf**) translates grid-based map analysis operations into a mathematical/statistical framework that is the communal language of STEM disciplines. This view suggests that the quantitative analysis of mapped data is either a direct or extended capability of existing non-spatial math/stat operations.

The most critical step in providing opportunities that further general awareness and understanding across campus is to recognize the inherent responsibility of non-GIS student education, as well as traditional GIS specialist. More specific actions might include—

- Encourage seminars demonstrating applications,
- Establish a networking organization encompassing all interested disciplines,
- Teach a class or lab for a department outside of your own,
- Organize or team-teach a discipline-oriented workshop with a domain expert,
- Write proposals for non-GIS teaching, research and outreach,
- Solicit VP-level administers to support for integrated efforts, and
- Maybe even adopting *Spatial*STEM as an extended means of communicating GIS's analytic capabilities to STEM communities.

OK, that's my Pollyanna perspective …what's the chance that an enlarged view of GIS education will ever take root on your campus? …what would it take?

(Berry lead). **What are the similarities and differences between GIS and non-GIS students (e.g., background, interests, time, career aspirations) and what similarities and differences are there in structuring course content and "hands-on" experiences (e.g., formal class, workshops, seminars)?**

My experience is that non-GIS students are less interested in the mechanics of GIS and more interested in how GIS might be applied in their field to solve problems. For past few years I have had considerable proportions of students outside of Geography/GIS in my graduate course in GIS Modeling at DU (more outside than inside this past term; 2 qualified undergrads). These students know little about traditional GIS concepts (geodes, coordinates, projections, V/R data structures, cartography, etc) but in most cases a lot about quantitative methods for analyzing data.

I use an easy-to-learn grid-based software package (MapCalc, ***www.innovativegis.com/basis/MA_Workshop/MapCalc_download.htm***) in the course that students load onto their personal computers along with the databases used in the weekly homework assignments. The 3-hour class meeting is consumed with lecture and discussion (no formal lab sessions). The students work in 2-3 person teams on their own and are expected to complete the homework assignment as a professional report (format, spelling, grammar, composition are graded) with discussion and appropriate screen grabs of their results. You can review all of the course materials (**www.innovativegis.com/basis/Courses/GMcourse12/**)to include lecture PowerPoints, exercises, exams and software used.

In addition I have conducted numerous workshops on GIS (**www.innovativegis.com/basis/basis/cv_berry.htm#Workshops**) for a wide diversity of professionals from foresters to farmers to faculty to retail marketers; from specialists to managers to policy makers; from 2 hours of lecture/demo/discussion to 2 days including hands-on experience. These settings most often focus on the analytical potential of GIS and are designed to get participants well aware that "maps are numbers first, pictures later" and ripe for map-*ematical* processing to uncover spatial patterns and relationships they can use in developing effective decisions.

I believe several "characteristics" of non-GIS students can be identified—

- Interested in applying GIS to solve problems in their field,
- Rarely to mildly interested in becoming GIS-specialists,
- What to know the basic concepts, procedures, considerations and limitations of the technology,
- Focused on the utility of GIS to them (minimally interested in RS or GPS),
- Concerned about the practical aspects of GIS (software, data availability) , and
- Generally interested in future directions of GIS

I believe some fundamental "characteristics" In structuring an educational offering for non-GIS students (course, short course, workshop, guest lecture/lab or seminar) to consider are—

- Tailoring the presentation to the audience's interests, disciplinary background and current spatial problems is critical (GIS for GIS sake is unacceptable)
- Instructor "Hands-on demonstrations" (or student hands- on exercises) are extremely valuable,
- Animated slides that sequence logical steps in developing a concept is preferable,
- Ample time/opportunity for discussion is important (Socratic questions as lead-in to topics are effective), and

- Links to online further readings/references are useful,

OK, that's my scar-tissue-based advice …what has been your experience(s) in presenting GIS to non-GIS folks? …what words of advice can you share?

(Kerski lead). **Given the advance and convergence of Citizen Science/Volunteered Geographic Information, mobile and easy-to-use geo-technologies, the open data movement, and cloud-based GIS, is everyone a geographer? Is everyone able to easily ramp into a GIS career?**

- GIS as an interactive "technical tool" for map viewing, navigation and geo-query is for everyone (potentially billions of users; negligible skills required),
- Map making today primarily involves choosing a template and following a wizard's guidance from the cloud so just about anyone can be a map maker (millions; minimal skills),
- GIS as an "analytical tool" is for many individuals as they augment their domain expertise with spatial reasoning and problem-solving skills (millions; considerable skills), and
- GIS as a career is not for everyone (hundreds of thousands; considerable skills).

(Bouwman lead). **How will cloud computing and interactive applications impact GIS education both from a GIS-specialist and a GIS-user perspective?**

- For the GIS specialist they need a working knowledge of structuring online databases and interactive services/solutions in the cloud, and
- For the GIS user they will be free from flagship software demands and will be able to utilize very large data sets and services from the get-go, and
- Lat/Lon grid-based referencing will become a universal key for joining currently disparate data sets in the cloud.

(Kerski lead). **What does the GIS education community need to do in the next 1 to 3 years to ensure that spatial analysis, geographic inquiry, and GIS are supported, taught, and used throughout the educational system?**

- Teach the teachers,
- Help construct tailored introductory lectures/labs for existing courses in other disciplines, and
- Develop/promote/offer courses for non-GIS students (ideally team-teach with domain expert).

(Bowman lead). **What types and levels of computer knowledge/expertise and quantitative methods will be required for developing successful GIS applications and solutions?**

- We need to develop in our GIS students a better understanding of grid-based spatial stat/math operations and quantitative analysis methods,
- Instill skills in general-purpose, high-level programming languages, such as Python, for integrating systems and programs with GIS, and
- Instill skills that are needed for the production and maintenance of websites (web design and digital media studies).

(General audience question). **What factors are most limiting to the continued development of GIS education on your campus (student interest, colleague backing, workload, promotion/tenure process, administration support, space, budget, etc.)?**

- Promotion and tenure doesn't fully recognize interdisciplinary efforts,
- Budgets for interdisciplinary courses and teaching are not readily available on most campuses, and
- Departmental workload does not provide time for efforts outside of the department.