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Reflections on PPGIS: A View from the Trenches

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Abstract: *The Community Geography Project is a Ford Foundation-funded program that provides training in Geographic Information System (GIS) technology and asset mapping methods to community-based nonprofit organizations in partnership with K-12 schools. The primary goal of the Project is to empower citizens, and it is hoped that the partnership between community-based groups and schools will be able to sustain technical and analytical expertise at the grassroots level. Although an overview of the lessons we have learned regarding access to hardware, software, and data are provided, this article focuses on questions regarding GIS training as related to citizen empowerment and provides examples of the iterative training process that the Project has developed.*

Introduction

The mission of the Institute of Portland Metropolitan Studies at Portland State University, Portland, Oregon, is to provide new access to the resources of higher education for area communities; to help increase an understanding of the metropolitan area of strategic value to citizens, faculty, students, elected officials, and civic leaders; to provide a neutral forum for the discussion of critical metropolitan policy issues; to create partnerships linking faculty, students, and community groups to meet community and scholarly objectives; and to sponsor public service research. The Community Geography Project of the Institute of Portland Metropolitan Studies was created to serve all of these objectives. Its focus is citizen empowerment through citizen use of Geographic Information System (GIS) technology. It recognizes the strength of GIS as an analytical tool as well as the power of its output (the map) to communicate and delineate power relationships (Harley 1989, McHaffie 1995, Pickles 1995). Furthermore, by providing technical training at the grassroots level, rather than merely providing community groups with GIS products, it acknowledges the notion that improved public access to GIS tools and data can create opportunities for community empowerment through the input of community-collected data, community-generated analysis, and map design as well as the potential lack of accountability by the agents (public and private) who have been the primary decision-makers with regard to spatial data collection, production, and provision (Chrisman 1987, Onsrud 1995, Pickles 1995, Craig 1998, Harris and Weiner 1998, Sieber 2000, Weiner 2001).

The Community Geography Project: The Approach

The unique graphic display of information and the analytical power that GIS technology can provide have the capability of enabling the user to ask new and better questions and to communicate spatially derived data, as professionals in geography, planning, environmental science, business, and the military have known for some time. Our work has focused on the question of whether or not that power can be effectively understood and utilized by the nonprofessional user, young or old, to empower community members to promote grassroots agendas and to build community.

Our involvement with Public Participation GIS (PPGIS) began some years ago with requests to offer training to grassroots organizations from community-based organizations that understood the value of GIS technology and asset mapping (a community-building method not necessarily linked to geography) (Kretzmann and McKnight 1993). None of these community-based organizations could afford to pay for professional services. Because of our mission to provide a neutral forum, to increase understanding of the metropolitan area of strategic value to citizens, and to focus on citizen empowerment, we were concerned at the outset about creating dependent community groups whose questions would inevitably be filtered through our lens. If we were to provide GIS and asset mapping training, we would also have to build the capacity within neighborhoods to enable community groups to have the freedom to explore the questions they care about most.

We quickly became aware that building this capacity within many community-based organizations was problematic because of overworked staff and the fluidity of the adult volunteer workforce. If we were truly going to build the capacity to do GIS and asset mapping in, for, and by the community, the expertise would have to be able to be sustained by embedding it into a community-based infrastructure (Leitner et al. 2002). Our proposed remedy is to promote partnerships between community-based organizations and K-12 schools to explore community-based issues together. With the rapid increase in the use of GIS technology across the professional and geographic worlds, the simplification and decreased cost of the technology, as well as an increased emphasis

on community-based education at the K-12 level, we made the assumption that GIS technology will be incorporated into the K-12 curriculum across the country in the not-so-distant future.

This approach has required us to focus on simple but powerful applications using readily available software that is either inexpensive or free, using datasets that are inexpensive or free, and using analytical tools and processes that are relatively easy to understand and by replicated by nonprofessional adults and young people. Citizen empowerment, we believe, requires transparency; therefore, "blackbox" processes, such as decision support software, are not used unless they can be created by the community partners.

Under the Ford Foundation funding, awarded in January 2001, we are providing training to six community-based organizations in partnership with schools over a two-year period (three in Year 1 and three in Year 2). We are in the process of completing Year 1 under this template and are working with the following partners on a variety issues:

- Old Town History Project/Metropolitan Learning Center/ Lincoln High School. Old Town, in Portland's downtown core was once the most ethnically and racially diverse area of the city. It currently houses the largest number of single-room occupancy residences in the region. This is an area that is surrounded by rapid gentrification. The project is focusing on collecting oral histories from current and former residents, historic census research including the creation of historic census geography, investigation into the City Archives and police records, the creation of historic address geography, and photographing and rectifying historic Sanborn Fire Insurance maps for GIS analysis. The project also includes the extensive use of hot-linking imagery and audio files (oral histories) to the Old Town GIS, with the understanding that all of the data will be geo-referenced, grounded in geography. Volunteers include members of the Chinese community, residents, historians, and young people. The GIS will be used for public outreach, historical analysis, and exhibit purposes.
- Sherwood Institute for Sustainability/Sherwood Middle and High Schools. Sherwood has the distinction of being the fastest growing city in Oregon over the last 10 years (under 3000 in 1990 to approximately 12,000 in 2000). Training in database development and GIS technology is being provided primarily to middle school and high school students, and to faculty to work with adult mentors such as: the Sherwood Police Department and SALT (Seniors and Law Enforcement Team) (database development and crime mapping); the local parks ranger (park trail and invasive species mapping); the historical society (detailed graveyard mapping); and the Chamber of Commerce (business and member maps). All projects are being used to leverage additional funding for the projects.
- The Wetlands Conservancy/CRUE Program, Open Meadow Alternative School. The Open Meadow School works primarily with students who have experienced limited success in traditional school environments, been expelled, or have dropped out of school altogether. GIS and database training is being given to students and faculty in a pilot project to monitor plant and animal life as well as water quality in three of the region's wetlands (one urban and two rural). This will feed into a larger statewide wetlands database project of the Conservancy.

Lessons Learned

The Community Geography Project is fundamentally a service project. However, an assessment component was instituted with the Ford Foundation grant primarily as a way for us to learn from and respond to the experiences of our community partners. Assessment consists of periodic interviews with the participants: community-based organizations, school participants, and Portland State University faculty and students involved in the work.

The Project has encountered many of the issues regarding access to hardware, software, and data that have been well documented elsewhere. Access to information also requires understanding or cognitive access. The issue of cognitive access has become central to developing solutions to the digital divide (Castells 1999, Resnick et al. 1999, Tardieu 1999). Presumably, the use of GIS technology increases cognitive access to information and is therefore empowering; however, this is dependent on the nature of the training available at the grassroots level.

Access To Hardware, Software, and Data

Hardware and Software. Although we might like to think that hardware access is less a barrier than it used to be, our experience in the community-based nonprofit and K-12 communities indicates that adequate hardware remains a problem. ArcView 3.2, the software we are using because ESRI makes it readily available to schools and because ESRI's GIS products are the most widely used, runs in a PC environment (many K-12 schools are primarily Macintosh environments) and requires more horsepower than is available. The computer labs in the schools that we have worked in have minimal support, are often overbooked, and are poorly laid out for the highly interactive teaching approach that we have developed. Given decreasing school budgets and limited funding available to community-based groups, this situation does not appear to be improving as rapidly as might have been assumed given the decreasing cost of computing power. New versions of GIS software, as is the trend across software applications, requires exponentially greater horsepower just to run. Our partners are dependent, at this point, on ESRI's continued support of the ArcView 3 product line. Community-based groups and K-12 schools may have to explore other options.

The Internet. All of our partners have Internet access, although in some cases it is slow.

Data. Although the state of Oregon provides some free spatial data online and there are numerous free or low-cost sources of data online, the most detailed and best quality spatial data available for the Portland metropolitan area are distributed

by our regional government (Metro) and is not free. One of the reasons for encouraging partnerships between community-based organizations and K-12 schools is that Metro's Regional Land Information System (RLIS) Lite product is available at a much lower cost to schools (one time only) than to non-profit organizations. Up-to-date data may not be critically important for grassroots purposes, since most of the applications that our partners have been engaged in involve linking new data to the base spatial layers. However, as we collect as much free data as we can to provide to our partners, we have become concerned about the increasing commercialization of data and what that could mean at the grassroots level.

Access to data implies the sharing of data, and the sharing of data is only valuable if the quality of data can be assured. As previously stated, much of the work that our partners are focusing on is adding new data (data collected at the grassroots level) to pre-existing base layers. One advantage of focusing on local issues is that the students readily understand the importance of scrutinizing data and the importance of metadata. In many cases, community members are well equipped to "ground truth" the data about their communities that they obtain from others. We have been fortunate to have an excellent model for metadata standards in the Data Dictionary provided with Metro's RLIS Lite dataset. We use it as a teaching tool, a resource, and as a model.

Internet Map Server Applications. When it comes to grassroots GIS, Internet Map Server (IMS) applications, as many of them currently exist, are problematic. We use them, especially those that focus on local geography (Metro's MetroMap, the City of Portland's CGIS, and the Portland Police Bureau's CrimeMapper) to introduce partners to possible applications and as sources for maps and data. However, these IMS applications are in no way "participatory" or transparent. The content that is served, the way that it is displayed, and the analytical capability of these IMS applications are highly controlled and difficult to use; they are clumsy, difficult to read, and they are exceedingly slow when using a slow Internet connection. The output is difficult to control and is less than optimal. Our experience indicates that after our partners have begun to work in ArcView, they see these applications as manipulative and frustrating because they have begun to see what a GIS that they can control can do.

There is the argument that most people do not want to have to learn GIS, do not want something complicated, do not want to have to work too hard to get the information they seek, and want to get the information in the privacy of their homes or offices. This is a valid argument for providing simple information that can be enhanced with a mapping interface, but it is not an argument that supports participatory GIS. Participation requires at least a cursory understanding of the importance of spatial concepts, spatial implications, and spatial data – an understanding of the language of geography. The IMS cannot fulfill this promise until the users of these sites have such an understanding.

Cognitive Access. Access to hardware, software, and data does not guarantee access to knowledge. Knowledge implies information with understanding. Being able to access data, even data displayed as maps, does not mean that the user can interpret the data. Maps are a kind of language that need interpretation or must be taught. As with access to hardware, software, and data, the cost of training in monetary terms and in time is related to quality and can be a substantial barrier. Addressing the issue of cognitive access is also considerably more complicated than purchasing products.

The Question of Training

Knowing that the Ford Foundation funding would ensure our partners' access to software and the RLIS Lite dataset and that our partners would have some in-house computing capability (access to hardware, software, and data), we have been able to dedicate most of our efforts to the cognitive side of access. Our funding has allowed us to provide weekly training sessions to all of our partners over 12 months.

The use of GIS technology can be seen as an iterative process that helps users to ask better questions. But to be able to use it in this way requires an ability to use the tools of a PC (particularly its filing system) and a basic understanding of spatial concepts, databases, spatial overlay analyses, and cartographic design. Without an understanding of spatial concepts, such as distance, proximity, and scale, users may not be able to recognize the importance of patterns that emerge through analysis and mapping. Databases are the core of a GIS. Understanding the importance of the database (its structure, requirements, and limitations) is necessary so as to be able to add and edit databases, perform analyses, and create structures for data acquisition. The ability to do spatial overlay analyses is what distinguishes GIS from other information systems. Understanding how and when various types of overlay analyses should be employed is central to the effective use of a GIS. Cartography is the graphic language of geography and the primary graphic output of a GIS. A fundamental understanding of basic cartographic principles such as the importance of projection, symbolization, classification, hierarchy, and color is necessary in order to be able to effectively communicate geographic information to others. And, of course, users must be able to operate the software.

GIS professionals spend years acquiring their expertise at universities, workshops, and on-the-job training. On the opposite end of the spectrum, what essentially amounts to software training is promoted by software vendors and consultants for professional users who want to update their skills and novices who want an introduction to GIS in tutorials, one-day to week-long workshops, or online courses employing generic datasets and canned exercises guaranteed to work. In these settings, students are not able to experiment with their own project ideas, to think through a process that has not been tested, to be allowed to "fail" and try again, or to take the time to become comfortable with the way the product works let alone learn how to approach geographic questions. Community college programs and technical certificate programs lie somewhere in between these two approaches, with greater emphasis on the technical than the theoretical (job training).

We have found canned tutorial and online options to be unsatisfactory in our community-based work because partners are interested in focusing on issues of concern to them, in other words local data, not just how to use the software. In our experience, middle school students, high schools students, and uninitiated adults can learn to use GIS technology effectively. However, GIS is best learned doing "real" projects in local neighborhoods and around issues that matter to them. And some level of success is necessary early on. There is very little patience for wading through artificial scenarios about unfamiliar places. In other words, interest in an issue is an important factor in driving learners through the learning curve. This is especially important at the grassroots level because in this context the goal is not job training but issue-oriented discovery.

Our partners can be categorized into two primary groups of users: adults and young people (middle school and high school aged students). In general, the middle and high school students have a much higher comfort level with computing technology than the adults. It can be safely said that most of the young people that we work with are fearless around computers; we have to run to keep up with them. The adults tend to be less enamored of the technology and more interested in the questions. With both young people and adults, our training has become highly interactive where the learners become teachers (young people teach other young people and adults) and teachers become learners (community members teach us, the teachers, about their communities – impacting of the direction of training sessions). Students of all ages are taught to question: the data, the choice of analysis, the analysis itself, the output, and how well and how accurately the output communicates its message. In this way, GIS is beginning to be understood by many of our partners as a vehicle for expression and a catalyst for change.

Conversations Using Maps and Data: Some Examples

Example 1

From the first day of training we invite our partners to begin to interpret maps about their communities. Figure 1 is race data from the American Community Survey for Multnomah County, Oregon (1996). The map on the left indicates the percentage of blacks by census tracts; the map on the right is the percentage of Asians by census tracts. In 1996, there were several census tracts with a black population of greater than 50%; in one census tract the black population was 67% – in a metropolitan area that was less than 7% black. Although the concentration of Asians is much less in any one tract, the Asian map indicates a pattern that is the flipside of the percent black population. There are many stories embedded in these simple maps, some of them uncomfortable. We invite our partners to tell us what the maps say to them, to develop questions, and to explore how they might investigate these questions further with and without GIS.

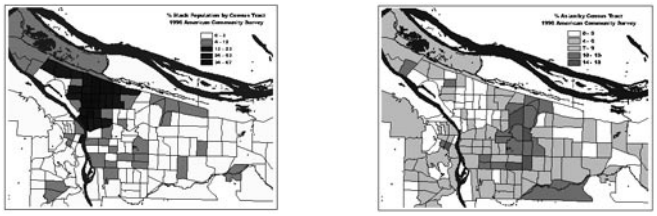


Figure 1. Percent Black and Asian Populations by Census Tract in Multnomah County.
Source: American Community Survey, 1996

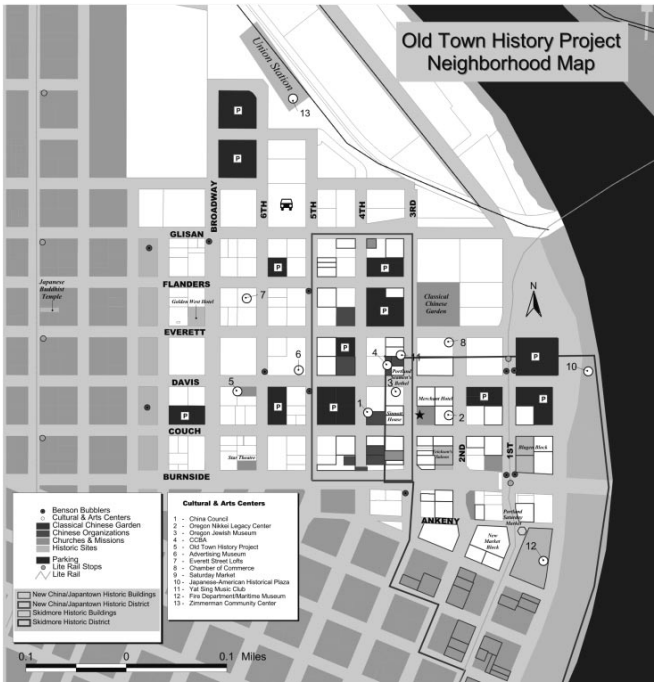
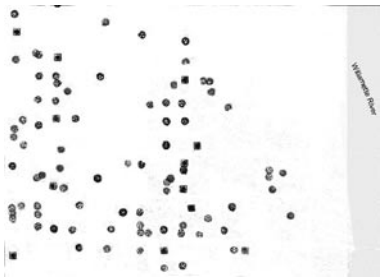


Figure 2. Draft: Old Town History Project Historic and Cultural Resources Map, 2002.



Map from the Report of the Portland Vice Commission, 1913.

Vice Commission points rectified to the street file in ArcView.

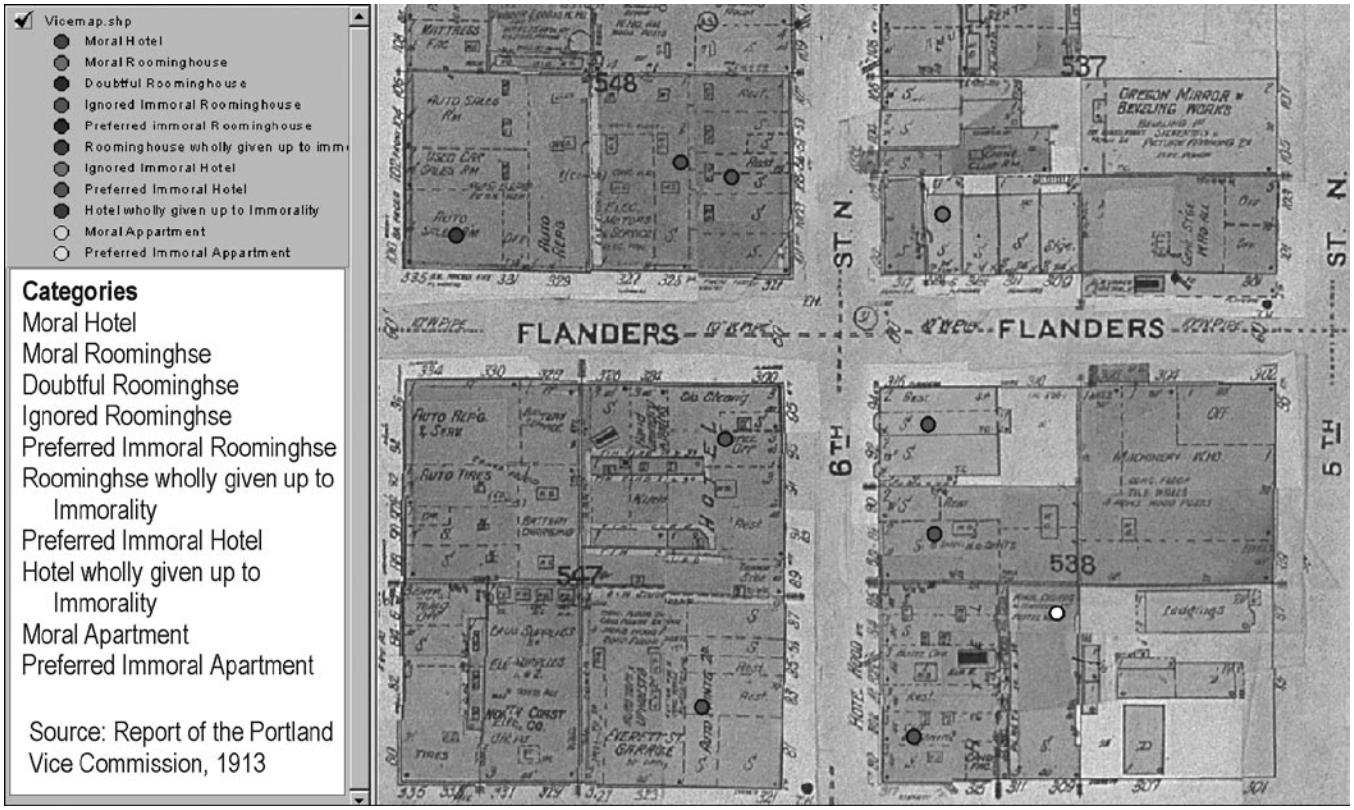


Figure 3. Historic vice mapped to the Sanborn Fire Insurance map by students of Lincoln High School for the Old Town History Project, 2002.

Example 2

The adult volunteers in the Old Town History Project are collecting information about cultural institutions and historic resources in the Old Town neighborhood. They are designing a map (Figure 2) that they hope to make available at their storefront site, neighborhood businesses, and the Classical Chinese Garden. However, the map has developed into a potentially politically contentious document. Because of increasing gentrification and a proposed code amendment that is in the works and that could threaten protection for historic resources, the volunteers with the Old Town History Project have decided to identify both designated historic resources as well as the boundaries of the Chinatown and Skidmore historic districts on this map. A second map, to be printed on the back of the first map, has been developed to include some of Old Town's businesses. Identifying which businesses to include is an area being debated. It is interesting to note that a decision was made to include the neighborhood's many soup kitchens in the restaurant category. This document has become a statement for inclusion that is very different from the typical tourist map. The geographic extent of the map goes beyond the neighborhood boundary established by the City into an area contested by the adjacent neighborhood association. The process of data collection and map design has brought many issues to the surface for open discussion. This very simple application, very do-able for these volunteers, has forced them to focus on the mission and goals of the Old Town History Project and think about the neighborhood in new ways.

Example 3

In early part of the 20th century, Old Town was the most ethnically and racially diverse neighborhood in Portland. It has been known at various times as "Chinatown" and "Japantown" and included significant communities of Greeks, Jews, and African

Americans. Additionally, it has had a long history of vice. With the discovery of the Report of the Portland Vice Commission of 1913 at the City Archives that included a map of geo-referenced "moral" and "immoral" establishments (minus the streets for confidentiality), some Lincoln High School students became very intrigued by the challenge of using GIS to map historic vice. Because we are only allowing our students to use software that is readily available to them (in other words, not ArcInfo), this has been a challenge. To tackle this question, we had to create a new street file with the old address ranges and add digitized images of some Sanborn Fire Insurance maps (Figure 3). Without going into detail, the tasks were relatively labor intensive and complex. However, we wanted to be sure not to lose sight of the opportunity that these points, once mapped, could offer us to delve deeper. What is the classification system all about? What do these locations really mean? How were they identified? How do they compare with the actual police records? Who were the property owners of the identified sites? Based on the police records and census data, who were the people involved in vice in this neighborhood in 1913? What does the activity and census data (which is no longer confidential) tell you about the place and how it functioned? Is there any way to reconstruct their personal stories? How does this relate to Old Town today? What began with points without streets becomes an inquiry with tremendous depth.

This approach has taken time to develop. We expected a relatively high level of geographic thinking from our partners to enhance their use GIS technology, and they have indicated to us that they have found this approach rewarding. Whether or not they will be able to carry on without us, a very important goal for us, is a real question. In large part, our community partners' independence will depend on an adoption of a community-based, multi-disciplinary GIS curriculum by K-12 districts that will continue to train students (who could also train adult partners), and the nature and quality of teacher training and support. We will be able to provide some minimal support for our Year 1 partners, and we are working on developing a curriculum for K-12 teachers.

Concluding Thoughts: Influencing Power

Asset mapping is a community-building strategy developed by John Kretzmann and John McKnight in An Assets Approach to Building Community: Mobilizing and Building Communities from the Bottom Up (1993), in which community members define what an asset is, identify the community's assets (individuals' skills and talents, community-based associations, institutions, as well as economic, environmental, and architectural assets), and develop schematics or "maps" indicating possible connections that exist and/or could be developed among the assets. Since the publication of this book and a series of additional workbooks and workshops, asset mapping has become wildly popular with community-based organizations and with consultants as evidenced with any Internet search on "asset mapping." This is a method that we have been asked by community groups to include in our training program. The use of GIS technology is a logical enhancement. John Kretzmann, at a workshop held in Vancouver, WA, in the Fall of 2000, stated that he was concerned that community groups had become so focused on the "mapping" step of the asset mapping process that somehow the "mobilization" piece was getting lost. In support of Kretzmann's own method, it could be argued that the processes of asset definition and identification are themselves a kind of mobilization. We, at the Community Geography Project, share this concern about our work in the community. The focus could end up being on the technology and driven by technology rather than the questions. This is why the process, learning how to train with the goal of empowerment front and center, has become so important to the work we do. By emphasizing critical thinking every step of the way, the questioning of data, the analysis, the output, and to understand that the tool is best suited to an interactive process with the data and a conversation with the map, we hope that GIS can empower community members to ask new and better questions and to seek innovative solutions to problems.

As the technology that drives GIS evolves and as we begin to develop a geographically literate society through our K-12 education system, it is hoped that the focus on the tool will become less of a necessity. As the computing processes become more and more embedded and "blackbox" in nature, there is a danger that, without an understanding of geographic inquiry and geo-spatial data (and the processes that the data are likely to undergo), uneducated users could become manipulated and therefore less empowered. This is why geographic literacy is so important.

I recently spoke to a GIS professional who suggested that there was no good reason to bring GIS into the K-12 environment and that community-collected data could not be used by professionals due to the lack of quality control. I am sympathetic to these concerns about data quality but not about GIS in the K-12 classroom or in the community. Our experience with young people, in particular, has shown that this generation can learn the technology relatively easily, that they are excited about seeing their community in new ways, and that, if used in the right way, it can be a vehicle for becoming involved in policy-related issues. At a time when fewer and fewer young people are voting, this is a very exciting development. Our experience with most GIS professionals has been incredibly supportive. But for the professional skeptics out there, the bottom-line is that GIS will be in K-12 systems if for no other reason than that ESRI is making it irresistible. How it is incorporated into the classroom and the community will determine whether or not geographic literacy, civic engagement, and grassroots empowerment can be achieved. One can only imagine what a nation of geographically literate citizens will demand in terms of data collection, data quality, access to data, political dialogue, and political outcomes.

About the Author

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