# Integrating GIS into the K-12 Curriculum

BY MICHAEL N. DEMERS

**Geography** has undergone some major changes in the past four decades. It has moved from a descriptive, place-name, rote-memory, purely academic exercise to a more prescriptive, decision-oriented, problem-solving discipline. A major reason for this shift is the advent of readily available, relatively inexpensive, software packages that are specifically designed for automating the processes geographers use in their applied work. This software, called Geographic Information Systems (GIS), was first introduced in the early 1960s by Dr. Roger Tomlinson of the Canada Division of Forestry and Rural Development. When presented with the problem of having to map, inventory, and make decisions about the vast resources of most of that country he quickly became aware that it was impractical to relegate this task to the use of traditional maps. The creation of the maps themselves would have required the employment of more cartographers than existed in the entire nation at that time. Additionally, once they were created, it would have been an extremely difficult, time-consuming task to measure, analyze, and interpret all of the information stored on those maps. What resulted was a concerted effort to develop the necessary computer software and hardware to automate the input, storage and retrieval, analysis, and output of geographic data. This system, called the Canada Geographic Information System (CGIS), was the first of what would become a vast array of such programs. Today GIS is a multi-billion-dollar-a-year industry.

Following the introduction of the software in its early years several universities began teaching courses in computational geography. These students, well-versed in both geography and computer programming, eventually contributed to cheaper, better functioning software. Over the years more and more courses in GIS began showing up in universities. Eventually the software became so functional that universities began teaching students how it was applied to solve everyday geographic problems such as finding the shortest path from one place to another, locating business in the most economically viable locations, predicting damage from natural disasters, planning communities, and hunting down serial killers. Today GIS courses are so commonplace in universities, especially in geography departments, that it is difficult to find one that does not offer at least one such course.

Recent enormous increases in the demand for improvements in GIS software shows two very important trends. First, there is an ever-increasing need for trained GIS professionals, and second, there is a parallel need to introduce students to the geographic concepts upon which GIS is based at an earlier age than has been done previously. It is no longer sufficient for these concepts to be introduced in the university. Both industry and academia see a need to introduce the geographic concepts as early as kindergarten. Responding to this need, one of the largest GIS companies in the world, Environmental Systems Research Institute (ESRI) based in Redlands, California, has created a series of easy to learn GIS software products, a variety of exercises, and technical assistance for K-12 teachers interested in integrating this useful and enjoyable technology into their existing classes.

While this is certainly self-serving for the GIS industry because its success will ensure that GIS will continue to improve both as software and as an industry, there is an equally important benefit to the K-12 instructors willing to accept the challenge of teaching some of the basic concepts and technology of GIS in their courses. As a former secondary teacher I remember my constant search for fun, relevant, activity-based instructional opportunities for my students. This K-12 GIS program is packed with interesting, practical, and highly educational exercises. Some of these require computers and software, while others are possible without the use of computer technology. Whole lesson plans can be prepared around these exercises or they can be incorporated into other, larger, subject oriented lesson plans.

Although the K-12 GIS curriculum provides lesson plan material for the instructor, it goes far beyond that. Students will begin to understand the basic concepts and importance of geographic space. For example they will learn why locations are important, how distance affects the interactions of people, how mathematics can be applied to geographic problem solving, how geography affects government and industry, and much

more. In fact, a primary focus of the K-12 GIS program is on problem identification and solving. Students who take part in this curriculum have an opportunity to apply what they learn immediately, rather than just memorizing geographic facts. This approach to geographic education is meant to develop not just a few well-versed geographers, but rather to create a whole generation of geographically literate people no matter what they do in later life. Thousands of schools across the nation are adopting some form of this curriculum with the result that college geography courses, especially GIS courses, in the next few years will be filled with students who are already far beyond the current level of college graduates.

What about the resources needed to do this? This question was presented to me as I introduced this same idea to a group of New Mexico Geographic Alliance participants in Albuquerque. The teachers made it clear that they didn't always have access to a single fully functional personal computer much less a laboratory filled with them. As I explained to them, the program provides ideas for how to raise money, how to access expertise from practicing GIS professionals and geography faculty, and a variety of highly successful techniques for convincing school administrators to place GIS laboratory needs as a first priority for funding. Moreover, this provides a wonderful opportunity for classroom teachers to interact with the community and to gain knowledge, expertise, and support for their classes and their schools. The program has already proven to be very rewarding for communities across the nation.

But even if your school is computer poor, you need not rely on the computer for the basic geographic concepts that drive GIS. The basic idea behind GIS is still primarily one of using maps. Although GIS allows the computer to assist in counting and locating geographic objects, comparing their sizes and locations, comparing one map to another, finding shortest paths, planning and zoning, etc., these can be reproduced without the need of a computer, especially at the lower grade levels. The exercises and expertise available through this program will provide ample ideas for introducing the basics of geographical analysis with or without the computer.

So, where do I begin? That's actually the easy part. ESRI has provided a mass of information on their Web site specifically created for your needs. Their direct Web address, www.esri.com/k-12, provides downloadable documents so you can read more about the program, names of contacts at the company to get you started, free downloadable data, program options for different school situations from wealthy to not-so-wealthy, free software, and much more. As you search this site please remember that there are many faculty in geography departments all over the United States that would be willing to get you started by making contacts, assisting in presenting your program proposals to your administrators, or instructing you in the ideas and technology of GIS. Alternatively, if you are not near a university, want to have some introductory information, but don't want to spend a lot of time downloading, then e-mail the ESRI folks at k12-lib@esri.com and ask for a CD called GIS for Schools and Libraries (version 5.0). It includes some free GIS software as well as exercises and data. There are versions for the PC and the Macintosh. Even a brief examination of the materials on the CD will provide endless ideas for introducing geographic analysis into your classroom. And once you do, many of you will be hooked on GIS. ◆

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