Project-Based Learning

Map Quests

GIS technologies allow students to tackle real-world issues while developing critical thinking skills. And, as the work of the students and teachers in Virginia who participate in James Madison University's Geospatial Semester program seems to indicate, it might just revolutionize project-based learning in K-12 schools.

By Jennifer Demski 09/12/11

Imagine a high school senior who could predict social uprisings in developing countries by mapping out data from the North African and Middle Eastern countries that recently experienced citizen revolts. Or offer recommendations for driver's ed and safe driver programs because of what he or she knew about the density of teen driving accidents over time in a specific region. Or determine whether there's a relationship between a neighborhood's socio-economic status and the amount of recycling that occurs in that community.

The technology that allows high school students to do these things--geographic information systems, or GIS--exists. And, as the work of the students and teachers in Virginia who participate in James Madison University's Geospatial Semester program seems to indicate, it might just revolutionize project-based learning in K-12 schools as students examine real-world issues at the same time they're strengthening their pattern recognition, spatial analysis, and higher order thinking skills.

Robert Kolvoord, James Madison professor of integrated science and technology and cofounder of the Geospatial Semester program, describes GIS technology as the union of databases and maps. "Think of the map as the window into your database," explains Kolvoord. "Similar to how Google Earth organizes information geographically instead of textually, GIS allows you to do the same, but with a great deal more control."

GIS users can input data on a particular subject into Esri's ArcGIS software, along with geographic information linked to that data. The data is then displayed as icons on a map, allowing the user to get a spatial understanding of the numbers represented in the data. Users can input and view data from multiple sources simultaneously on a single map, with each source appearing as an independent layer of information, which allows them to identify trends or patterns across data types.

For instance, if students wanted to see the correlation between bicycle lanes and bicycle safety, they might find data on bicycle accidents, on bicycle citations, and then on bicycle lane locations. They then could select the parameters they want to study, input the data, and create a map that demonstrates the density of incidents in each location. With this visual representation of the data on a density map, they can easily see any patterns that might suggest a relationship between bike lanes and bike safety.

Kolvoord created James Madison's Geospatial Semester program in 2005 as a way to engage high school seniors in their final semester--a time when many seniors lose interest in school--by exposing them to the transformative aspects of geospatial technologies and furthering their understanding of the field of geography. At this point, the program is available only to schools in Virginia but, Kolvoord says, "The whole idea was meant to be franchiseable, in that it could stand up at different institutions. The Geospatial Semester is a way to offer these seniors a combination of geography, technology, and spatial analysis skills by having them do extended projects that would flex their mental muscles and offer them a better connection to the real world."

But wait, there's another incentive.

Students who participate in the Geospatial Semester have the opportunity to earn three to six transferable college credits through James Madison. Depending on the student's final project, the credits can be applied to either science or humanities courses.

Widespread in Industry

GIS technology is already heavily used in a wide variety of industries. Business and marketing, advertising, insurance, healthcare, transportation, public safety--any field that relies on data to

increase efficiency and effectiveness likely also relies on GIS technology to hone in and pinpoint areas that require attention. Its use in education, particularly in K-12 schools, is relatively new, mainly because of the investment of time required to master the technology. That's why Kolvoord runs the Geospatial Semester as a "mentor dual enrollment" course rather than a typical dual enrollment course in which a high school teacher is anointed an adjunct teacher for a local community college, provided with a college syllabus, and then turns in his students' grades at the end of the semester.

« previous 1 2 3 next »

Comments

Add your Comment

Your Name: (optional)

Your Email: (optional)

Your Location: (optional)

Comment:

Please type the letters/numbers you see above

Submit

Share this Page

LinkedIn	Facebook	Twitter
Google	Digg	del.icio.us
Technorati	Slashdot	Newsvine
Reddit	Fark	Yahoo!

Sponsored Links

White Papers:

- Promethean Education Strategy Group: A Whole Team Effort To Driving Change

For five consecutive years, Golden Avenue Elementary School didn't make AYP. To avoid state take-over, Principal Rick Oser developed a "whole team approach" leveraging interactive technologies to increase engagement and learning outcomes.

Read more...

all white papers

Project-Based Learning

Map Quests

09/12/11 **Page 2 of 3**

With the mentor dual enrollment, Kolvoord and another university faculty member visit the participating classrooms throughout the semester and provide technical support, training manuals, and project mentoring to the program "instructor" (typically a teacher from that school) and the students. "In the GIS world, data is one of the biggest challenges," explains Kolvoord. "We help the students and teachers shape their projects and identify data sets, and find data that is available and appropriate."

Students draw data from any source that houses information applicable to their projects: the US Census, US Geological Survey, and records and reports created by local cities, towns, and counties. Students can even collect the data themselves, using handheld GPS units to compile data that will then be spatialized and connected to a map through ArcGIS. At Western Albemarle High School in Crozet, VA, earth science instructor Paul Rittenhouse had his students compile data on the strength of the school's WiFi signal throughout the building and create a coverage map similar to the maps provided by cell phone providers. "We were able to take this to the district IT department so they could see which areas had strong connectivity and which areas were dead zones," explains Rittenhouse, "so they could reassess where they placed their wireless transmitters and better serve their equipment and their end users."

Rittenhouse began incorporating GIS technology into his earth science curriculum in 2003, and immediately saw the value the technology could have across all disciplines. "It's a challenging piece of software," remarks Rittenhouse, "and once it engages you, you want to learn more about what it can do. As you expose yourself to different GIS projects, you see that there's a skill set that's enhanced by the software that isn't necessarily about science. It's applicable to government, civics, history, business. GIS isn't a flash-in-the-pan technology. It can be done in cooperation with whatever topics are being studied to take student engagement a step further and help students understand what's being taught on a deeper level."

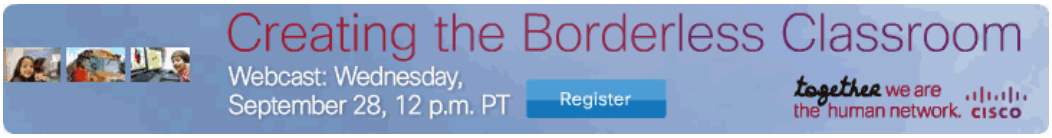
Rittenhouse began teaching a stand-alone GIS course through James Madison's Geospatial Semester in 2006, and now works with teachers throughout his district to incorporate GIS units into their curricula. Rittenhouse adds, "The drive behind GIS isn't the software. It's about helping the students develop a process of thinking, based on inquiry, and being able to transfer that process of thinking to make better informed decisions in a variety of topics."

Patterns Are the Real Issue

The ultimate goal of the Geospatial Semester is to have each student present findings on a topic of their choosing to their teacher and the James Madison staff, but teachers spend the first part of the course modeling and demonstrating projects to the students as they learn the capabilities and purpose of the technology. As Ryan Miller, a teacher at Washington-Lee High School in Arlington, VA, explains, "The biggest obstacle is making sure they can take the technology and the tools that we teach them, and use those to explore the topic that they're interested in studying. The focus of the program isn't the technology, it's the development of the pattern recognition and spatial thinking skills that the students gain through the application of the technology." Miller might have his students begin the course by looking at a city's crime data in relation to its demographic and socio-economic data.

After that introductory phase, students are encouraged to explore a topic of their choosing as the focus of their extended project. Topics in Miller's class have ranged from the influence of wealth on recycling to patterns in the recruitment of hockey players worldwide. One student analyzed historical flood data for the nearby Potomac River, and layered that with current property data to identify properties that could potentially be damaged in the event of a major flood. At the same time, the student estimated the monetary value of the potential property loss--the type of data analysis done every day in the insurance industry.

« previous 1 **2** 3 next »



Project-Based Learning

Map Quests

09/12/11 **Page 3 of 3**

Another student created an index that evaluated which communities in the Washington, DC, area offered residents the highest quality of life. "He came up with his own metrics to evaluate and demonstrate quality of life: access to transportation, pollution levels, and so on," remarks Miller. "It's projects like that one that constantly and consistently amaze me."

Rittenhouse's students at Western Albemarle High School are responsible for the analyses of composite predictors of social upheaval and common factors of teen driving accidents mentioned above, among others. "This technology can be used to look for relationships and patterns in so many different topics," remarks Rittenhouse. "We've had a lot of students who've gone on to pursue degrees at four-year institutions come back and say that they'd be really upset if they'd gone through high school without being exposed to GIS technology."

In Rittenhouse's view, the biggest obstacle he and other GIS teachers face now is lack of awareness of the technology among students and educators. His superintendent, Pam Moran, is on board with helping him increase that awareness, and has even had students in Geospatial Semester courses throughout the district's high schools use it to assist in administrative matters. By feeding data gathered from GPS systems installed in the district's school buses into GIS software, students were able to reroute them and reduce bus transportation by 25 percent--a boon to a district that covers 726 square miles. (For more on the use of geospatial technology in school transportation, see "The Long [Inexpensive] Bus Ride Home" on page 22)
With Moran's support, GIS technology is being incorporated into the curriculum all the way down to the elementary schools, where students work on basic mapping projects. "It's critical that students have the opportunity to look at patterns, to be able to make sense of them, and to be able to transfer their understanding of how patterns emerge and become something that leads to generalizations and understanding to new situations," remarks Moran. "The GIS-based projects that are being tackled in the classrooms of teachers like Paul Rittenhouse are 21st century learning in its ideal form."

« previous 1 2 3 next »

About the Author

Jennifer Demski is a freelance writer in Brooklyn, NY.