Creating Career Paths for Geospatial Technology Professionals

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Abstract

GIT Ahead focuses on workforce preparation in Geospatial Information Technology (GIT) fields through teacher professional development, educational software development, and provision of internships, job shadowing, and career preparation experiences for high school students. A collaborative effort among the Finger Lakes Institute at Hobart and William Smith Colleges, Cayuga Community College, Cornell University, the Institute for the Application of Geospatial Technology, and NYS Geographical Information Systems Association, the goals of GIT Ahead are for teachers to use GIT in their science classes and for students to gain perspectives on GIT careers through classroom projects and internship opportunities. To facilitate educational uses of GIT, we are developing Internet-based GIS software for exploration of environmental issues in NY's Finger Lakes region. In this session, we will explore the challenges of helping students envision GIT career options through teacher professional development and classroom implementation of projects using GIT to address local environmental issues.

Introduction

Geospatial Technology Workforce Needs

Geospatial technology is one of the three most important emerging and rapidly evolving fields in business and industry. In the U.S. and abroad, the geospatial market is undergoing a period of very strong growth (Gewin, 2004). The American Society for Photogrammetry and Remote Sensing indicated 9-14% annual growth in the geospatial industry, with predicted revenues in the United States alone topping $6 billion by 2012. NASA has estimated that 26% of their most highly trained geotechnical staff members are due to retire in the next decade. According to the US Department of Labor (2004), the geospatial industry supports numerous technology-based occupations, including mechanical engineers, transportation managers, urban planners, cartographers and photogrammetrists, surveyors, environmental engineers, electrical engineers, geologists, survey researchers, and market analysts. For professionals in these fields, geospatial

technology literacy has become essential. In recognition of this situation, in 2004 the Department of Labor earmarked nearly $6.4 million to help meet workforce needs in the geospatial technology industry.

Employment trends for surveyors and mapping technicians are projected to increase by 23% nationally between 2002 and 2012, while job openings in cartography and photogrammetry should increase by 15% during that same period. Employment opportunities for those fields within New York State also are significant. While professional positions that utilize GIT are not limited to mapping, these statistics provide estimates of the growth orientation trends in the geospatial field as a whole and serve as an impetus for designing education and training opportunities to meet existing and up-coming workforce needs.

The GIT Ahead Project

GIT Ahead is a multi-institutional collaboration focusing on use of geospatial information technologies (GIT) by secondary teachers and students. Launched in 2006 with funding through the National Science Foundation's Advanced Technology Education program, the project aims to help secondary students see geospatial technologies as pathways to relevant, exciting, and high-demand careers and to create higher education pathways for students who might not otherwise pursue such goals.

Cayuga Community College, one of the partner institutions in GIT Ahead, offers a GIS Associate's Degree program that prepares students to enter the workforce as technicians or to transfer to a four-year institution for continued undergraduate studies. This community college program serves a variety of students who had not otherwise thought of attending college. However, it currently is undersubscribed, and many high school students, teachers, and guidance counselors are unaware of the career opportunities afforded to interested students. The GIT Ahead project is working to overcome this discrepancy by providing GIT-related career awareness, job shadowing, and paid internship opportunities for secondary students in the Finger Lakes region of New York State, along with experiences using GIT in secondary science classes.

Use of Geospatial Technologies in Secondary Science Classes

A major focus for GIT Ahead is to help secondary teachers incorporate geospatial technologies into their science teaching, focusing in particular on courses for at-risk students. Using geospatial technologies to explore environmental issues enables teachers to address multiple goals put forth in the National Science Education Standards (National Research Council, 1996) and the National Educational Technology Standards (International Society of Technology Education, 2000). A recent report from the National Research Council recognizes the importance of spatial thinking in everyday life and recommends that it be embedded across the K–12 curriculum (National Research Council, 2006). Using geospatial technologies, students gain analytical and technical skills while also learning to "understand the ethical, cultural, and societal issues related to technology, practice responsible use of technology systems, information, and software, and employ technology in the development of strategies for solving problems in the real

world" (International Society of Technology Education, 2000). Most importantly, students applying GIT in these contexts "develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity" (International Society of Technology Education, 2000).

Each year, GIT Ahead begins with an 8-day summer institute in which high school and middle school teachers learn how to address relevant local environmental issues using global positioning system (GPS) and geographic information system (GIS). The teachers develop inquiry-based curriculum projects applying these technologies to local environmental issues. GIT Ahead teachers currently are working with sixth through twelfth grade students in science classes ranging from remedial level to International Baccalaureate. Their students are learning science, enhancing their technology skills, and potentially gaining motivation and interest in pursuing related careers.

Curriculum Development

One of our goals in GIT Ahead is to develop and pilot a collection of curriculum resources enabling students to learn science through application of geospatial technologies in analyzing relevant environmental issues. Each active GIT Ahead teacher designs and implements an individualized curriculum project, applying geospatial technologies to environmental issues as applicable in their sixth through twelfth grade science classes. Topics range from "Rediscovering a Sense of Wonder with Geospatial Technology" to "What is Global Warming and how does it relate to GPS and GIS?" Teachers enrolled in the graduate course that we offer are writing lesson and unit plans in a consistent format for publication on our project website. Three of the teachers have become so excited about the potential of GIS for student learning that they currently are proposing to their school districts the establishment of new high school GIS courses.

The GIT Ahead project team also is developing classroom-ready resources for use in professional development workshops and made available on the project website. In support of these curriculum development and implementation efforts, we are developing a matrix of environmental issues in the Finger Lakes Region, currently under review by collaborating science faculty. We envision that this matrix, coupled with the compatibly formatted Finger Lakes Region GIS datasets we have assembled, will greatly enhance the feasibility of implementing GIT-enhanced environmental science projects in participating secondary science classes.

Challenges

Reflecting back as we conclude our first year in GIT Ahead, we have identified an ongoing set of challenges and an evolving set of strategies for maximizing the potential for GIT use in secondary classrooms.

Time

We have found that the most daunting aspect of using GIS in schools is the vast amount of time that can be required to assemble applicable datasets with compatible projection and scale. Consequently, we have compiled Finger Lakes datasets for use by GIT Ahead teachers and students, with everything ready to download and use with ArcGIS 9.2.

Teachers have told us that this removes a huge obstacle to having their students manipulate real data to address relevant local environmental issues.

Time also presents a challenge when over-packed curricula leave little room for new topics. We are striving to overcome this constraint by enabling teachers to teach required content in new and hopefully more effective ways. For example, water quality lessons in school science classes commonly focus on collection of chemical, biological, or physical water data. Because these monitoring efforts typically do not begin with a research question, students do not learn to interpret their results and apply their findings to local issues in a meaningful or useful way. When students relate their monitoring data to an environmental issue referenced to the local landscape, their field and laboratory work gains relevancy, and the students gain analytic and critical thinking skills. We have seen that as teachers become more confident in their own GIT skills and related teaching strategies, they begin weaving geospatial technologies into a growing list of topics throughout the school year.

Distance

Working with teachers throughout a 14 county region of New York State creates logistical and pedagogical complexities. During our 8-day summer institute, we provide housing for teachers who are not within commuting distance. Travel time becomes an issue, however, for six Saturday workshops we hold during the academic year. To reduce travel difficulties, this winter we piloted distance learning workshops in winter months through use of web-conferencing software. This enabled us to carry out many of the same activities as in face-to-face workshops, and the teachers enjoyed the chance to connect from home without having to travel in potentially inclement weather. However, we found it more challenging to meet the needs of teachers of widely varying technological capabilities using web conferencing compared with face-to-face workshops. When a teacher needed technical assistance, for example, the facilitator needed to focus on that individual until he or she was back on track, breaking the flow of the presentation for other participants.

Diverse Needs

An additional challenge of GIT Ahead is that we are working with a diverse group of teachers who have widely varying expertise and self-efficacy with regard to geospatial technologies. Some have considerable experience using GIT and join the project so they can focus on curriculum development within a supportive environment. Others can envision the potential of GIT but have little prior experience using these technologies. During workshops, 20% of the teachers seem to need 80% of the support and guidance.

We deal with this challenge in several ways. First, we provide teachers with tools, skills, and experiences that they can adapt and modify to meet their own specific needs and objectives, along with time during each workshop devoted to development of their own curricular ideas and applications with guidance or technical assistance from project staff as needed. We also provide virtual office hours on a weekly basis, during which teachers can receive individualized assistance from project staff as needed. Finally, we place teachers in heterogeneous ability groups for project work during the summer institute,

enabling less experienced teachers to learn from those with more advanced GIT experience and training.

Not only do the teachers have diverse technological skills, they also have widely ranging curricular needs because the project encompasses 6th through 12th grades and courses ranging from general science to biology, earth science, environmental science, and conservation. A single approach or set of strategies clearly will not work for all participating teachers. Instead, we model lessons that are applicable in grades 6-12, with different levels of conceptual understanding or analysis required at different grade levels. At each workshop, we present these curricular ideas along with guidance in how to use appropriate software tools, and then we provide plenty of time for individual interactions through which we can help each teacher meet his/her own classroom goals. The consistent positive feedback we have gotten from teachers suggests that this approach effectively meets their needs.

In recognition that full-fledged use of desktop GIS is not feasible in many classrooms (Baker, 2005), we are providing a range of geospatial technology options. In GIT Ahead workshops, we introduce teachers to web-based geospatial software including Google Earth, NASA World Wind, and GPS Visualizer, a free online utility that enables users to create maps using GPS data. For workshops designed to introduce teachers to potential applications of geospatial technologies, we also are creating stand-alone curriculum modules utilizing ArcExplorer – Java Edition for Education (AEJEE).

Through GIT Ahead, we also are creating an education software package called the Finger Lakes Explorer, which will provide a relatively simple GIS interface coupled with region-specific data ready for use in analyzing questions of local environmental interest. Designing this software to meet teachers' needs is challenging because the schools in which they work vary widely in terms of available technology and tech support practices. For example, some districts have low bandwidth capabilities, others restrict installation of software or downloading of data, and others remove all saved files on a regular basis. We also are striving to reach a balance between ease of use and power of user control, a common issue in software development.

Career Awareness

A final challenge in GIT Ahead is that our goal of increasing GIT career awareness among secondary students is a step removed from applying geospatial technologies in science classes. Each year a few students receive paid GIT internships. For the others, we are working to develop smaller scale experiences that will highlight the opportunities available for those interested in pursuing GIT-related careers. Such experiences include career-focused presentations in classes or at career fairs, field trips to visit the GIS program at Cayuga Community College, provision of brochures and posters to school guidance offices, and working with existing job shadowing and vocational education programs to incorporate geospatial career options.

Conclusions

In this first year of the GIT Ahead, it is too soon to determine the project's success in creating career paths for geospatial technology professionals. The project is complex, including professional development for teachers, curriculum and software development, and establishment of internships, job shadowing and other career awareness opportunities for students. Our major finding to date is that middle and high school teachers are enthusiastically embracing the possibilities of teaching core science content using geospatial technologies as they design and teach lessons and units for their classrooms. Students in courses ranging from remedial to advanced levels are rising to the challenge of learning and applying these technologies to relevant environmental issues. In coming years we will be exploring the extent to which exposure to geospatial technologies in secondary science classes expands students' awareness of and interest in pursuing GIT-related careers either at the technician level or beyond.

For more information about GIT Ahead, see http://fli.hws.edu/gitahead/.

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