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## Meeting the Challenge: Integrating Geographic Technology into Today's Social Studies Classroom

Elizabeth Bloom and L. Jean Palmer-Moloney  
Winter 2004 Issue

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### Abstract

Current state and federal education mandates to improve performance on assessments have left geography vulnerable to exclusion from the social studies curriculum. Geographic Information Systems (GIS) provides a framework from which to teach history, a subject highly represented on New York State's 8th grade social studies assessments. Designing modules that use geographic technology to deliver the history curriculum ensures that geography can survive the winds of political change in education. GIS technology also provides a conduit for varying pedagogical methodology thereby reaching a wider variety of learners, particularly those with a strong spatial intelligence. This research describes the effectiveness of GIS-based activities from the perspective of teachers and students.

### Introduction

The need for resilient geographic education that can survive political directional change is critical if geography is to maintain a place in the K-12 curriculum. In our efforts to integrate geography effectively into the middle school social studies curriculum, we have found that Geographic Information Systems (GIS) can serve as the perfect conduit. Creative application of GIS by the social studies teacher can successfully tie together the mandated history, geography, and technology curricula, the unique needs of middle school students, and the requirements of national and state assessments.



Photo by Shannon White

In the past three years, we have developed and piloted several GIS enriched social studies modules for use by eighth grade students in a public school

setting. These modules were designed to align with the required New York state curriculum and to help students meet the middle level social studies standards mandated by the state. Our research is qualitative, our approach is action-oriented, and takes place in the “field” rather than from a passive distance (Palmer-Moloney and Bloom 2001, 641-654). Upon presenting our work in local and national forums, the feedback has been overwhelmingly positive from all arenas - middle school students, administrators, geographic educators in academia, secondary educators, and industry.

In this article we present findings regarding the integration of geospatial technology into the middle school social studies curriculum from the perspective of students and teachers. Then, we highlight two of the modules we have created that are based in GIS technology.

### What is GIS?

GIS (geographic information systems) are computer-based programs that are used to create, analyze, model, and map information based on spatial relationships. The interconnections between spatial data are shown as layers of information that can be “stacked” to help the user determine the significance of various features called “attributes.” Attributes include either elements from the physical world, such as elevation, floodplains, river systems, and climates, or elements related to socio-economics, such as income, transportation/communication networks, language, and race/ethnicity.



Figure 1 Source: ESRI

Professionals in many fields use GIS to explore relationships between features distributed unevenly over space, seeking patterns that may not be apparent without using advanced techniques of query, selection, analysis, and display. (For more information on GIS and its many applications, go to <http://www.esri.com>.) Educators can use GIS as a tool for map-making and data processing, but also as a mechanism to gain a deeper understanding of conditions and events relating to both the physical and social sciences.

### Why it Works

It is well established that students learn in different ways and that students have different intelligence strengths. Howard Gardner, of Harvard School of Education’s Project Zero, first presented the theory of Multiple Intelligences in 1983 with his seminal book, *Frames of Mind*. This theory posits that intelligence is not uniform, and that people possess at least eight exclusive intelligences including the musical, bodily-kinesthetic, logical- mathematical, linguistic, spatial, interpersonal, intrapersonal, and naturalistic. Gardener states that, “An

intelligence entails the ability to solve problems or fashion products that are of consequence in a particular cultural setting or community” (Gardner 1993, 15). ( For more information on Howard Gardner and his Project Zero work with intelligences at Harvard, see <http://www.pz.harvard.edu/>.) These separate capacities are of coequal value and are possessed by individuals to different degrees. However, traditional US academic achievement measures rely almost exclusively on linguistic and logical/mathematical intelligences. Students who do not excel in these areas are found to be deficient learners requiring remediation. New York State Department of Education regulations, for instance, define a learning disability as, “...a disorder in one or more of the basic psychological processes involved in using language, spoken or written, which manifests itself in an imperfect ability to listen, think, speak, write, spell, or to do mathematical calculations” (NYSED Commissioner’s Regulations 2002).<sup>1</sup> Failure in other intelligence areas, for example interpersonal intelligence, carries virtually no weight in assessing student achievement outcomes despite the fact that high interpersonal intelligence is a significant predictor of life success (Goleman 1997, 38-39).



Photo by Shannon White

The current standards movement requires that schools demonstrate academic achievement using testing instruments that rely entirely on mathematical and linguistic intelligences. This movement was born in 1994 when President H. W. Bush’s Goals 2000 Educate America Act (PL 103–227, signed into law in March 1994) required most states to develop a high-stakes testing structure. Emphasis in education, generally, and geography, specifically, has shifted from process—problem-based, creative,

and infused with critical learning, to product--high achievement and accountability on the part of students, teachers, and administrators (Palmer-Moloney 1998). Now, the *No Child Left Behind Act*, signed into law by President G. W. Bush in January of 2002, requires that all states develop systems of accountability that include yearly math and English language arts testing for children in grades 3-8.<sup>2</sup> Educators anticipate that this law will result in an investment of state energy and funds on improving achievement in the linguistic and logical/mathematical intelligence areas. Unfortunately, multiple intelligences and their associated learning styles do not fit into the narrow parameters measured on current standardized tests; often they are pushed into the background or eliminated altogether (Palmer-Moloney 1998). Students who excel in other intelligence areas have fewer opportunities to demonstrate their learning and mastery of subject matter.

Unlike history and the other social sciences (economics, sociology, anthropology, and political science), geography focuses on the use of the spatial intelligence. Spatial intelligence, also known as “visual” intelligence, involves the ability to solve problems associated with navigation, the use of notational system of maps, and the use of space in the visual arts (Gardner 1993, 21-22). In our research we have observed that students who are classified as learning disabled frequently perform at exceptional levels when allowed to use their spatial intelligence. These otherwise “slow” students are strong visual learners who see and understand the graphic presentations offered by GIS displays. GIS provides spatially intelligent students with an alternative route by which to acquire information that would have otherwise bypassed them if delivered solely by traditional pedagogy. GIS-based modules allow these students to shine

among their classmates, a particularly satisfying outcome for a teacher who wants to see all her pupils experience genuine success in academic classes.

GIS helps students and teachers at any grade level to engage in studies that require and promote critical thinking, integrated learning, and multiple intelligences. In addition to all of these pedagogical considerations, students, were generally highly motivated to take on the challenging GIS technology because they enjoyed doing something that they perceived as “fun.” GIS adds a hands-on element to the lessons and, to the eighth graders, produces impressive, professional-looking maps.



Photo by Shannnon White

In our earlier work, we demonstrated that geography is underrepresented in the New York State (NYS) middle school classroom for a variety of reasons (Palmer-Moloney and Bloom 2001, 641-654); most significant among them is the lack of representation of geography on the NYS social studies assessments.<sup>3</sup> The constrictions of time, the breadth of the required history curriculum, the lack of resources, and the special characteristics of young adolescents, force teachers to make curricular decisions about what they must omit. Pressure to demonstrate achievement on assessments means that teachers eliminate information that is not assessed. A primary content area to be eliminated is geography in the interest of history, which has a dominant place on the state exams (Palmer-Moloney and Bloom 2001).

The question then becomes how to integrate geography in such a way that teachers do not perceive it to be extra curriculum. In our work we have found that GIS enhances the history curriculum and provides a way to teach geography, as it smoothly integrates places with time. We have created units that are aligned with the NYS social studies standards and that meet the needs of a wide variety of learners. GIS is about the integration of information and we have employed it to allow students to recognize the interrelationships between the physical and human factors that drive history.

## **Underground Railroad**

Our first successful effort at making the connection between geography, technology, and history was in using GIS to expand and deepen the student understanding of the Underground Railroad.

### *Overview*

In the antebellum United States, the Underground Railroad served as a series of safe houses and individuals who assisted fugitive enslaved persons. The Underground Railroad helped these fugitive slaves find their way to safety in the north by providing food, shelter, transportation, and sometimes false documents. After the Fugitive Slave Act was strengthened by the Compromise of 1850, it became illegal for citizens throughout the United States to refuse to assist in capturing and returning fugitives to their owners. Concurrently, the punishments for assisting fugitives became quite prohibitive. In spite of the personal risk, thousands of citizens continued to assist fugitives.

By 1860, it is estimated that between 40,000 and 50,000 fugitive slaves lived in Canada. Because of the clandestine nature of the Underground Railroad network, it has been difficult for historians to ascertain the exact routes, numbers of fugitives, and identities of the “conductors” who helped the escapees along the way. Many of the enslaved people who decided to flee bondage in the South simply located and followed the North Star, Polaris, and began a long, lonely trip north to freedom. Canada became the destination for fugitives who were intent on a secure freedom. To this day, the Underground Railroad remains an intriguing subject with much to explore, and it is especially compelling for young adolescents with their strong aversion sensitivity to injustice.

Student pairs began this project by reading the authentic biographies of individuals who had successfully escaped slavery. (Palmer-Maloney and Bloom, 2001) Using information gleaned from these primary documents, students employed atlases to make an initial list of Underground Railroad stops and plotted them informally on a paper outline map of the United States and Canada. The students were then instructed to create journals matching the locations on their initial maps. Biographical details from their subject's escape narrative and geographic information culled from the atlases were to be woven into the journal entries. The third and most salient component of the project involved mapping the route of their subject's flight to freedom using ArcView 3.2 GIS software. Students produced photo-quality maps with at least ten stops that replicated the actual routes of their subject and then complemented their journal entries.<sup>4</sup>

Table 1 - Elements of the Pull of Polaris Module

	<b>Description</b>	<b>Goals/Objectives</b>	<b>GIS skills</b>
Step 1	Read authentic fugitive enslaved person's biography	Chart routes on paper outline maps; analyze risks and benefits of fugitive's route to freedom. Determine pros and cons of using escape route through Kentucky/Ohio v. escaping via Eastern Seaboard	Use GIS shape files to determine the route's elevations and the rivers that had to be crossed
Step 2	Create journal entries	Glean geographic information from primary document	Find features on GIS map using identify tool; Incorporate geographic details from fugitive's biography into journal entries
Step 3	Create final GIS map	Plot geographic locations from journal entries; Label salient physical and human features along the route	Use the “Draw” tool and latitude/longitude coordinates to draw escape route; Print final map.

### **Immigration: Destination - New York City**

*Overview* - Another successful module we created deals with immigration at the turn of the 20th century. Between 1870 and 1915, 25 million Russians, Italians, and immigrants from other European nations flooded into the United States. They came in hopes of finding a new life of freedom and prosperity, and they met both opportunity and hardship. For many immigrants, their first steps into the United States were taken at Ellis Island. In fact from 1892-1924, as many as 1000 people per day passed through the immigration checkpoints there to begin a new life in the United States. Many of these new immigrants left Ellis Island and settled in nearby New York City.

Students first completed an in-class lesson on the flood of “New Immigrants” who emigrated to the United States, and particularly to New York City, from Eastern and Southern Europe. This module logically followed the module on the Underground Railroad, and the skills needed to do this module drew on skills already developed (at least to a minimal degree) from the earlier unit.

Following the introductory lesson, students explored various religious, political, and economic factors that pushed people from their homelands during this era. Students then analyzed the factors that pulled people to the United States - the democratic values and economic opportunities - and the ways in which these factors sustained new arrivals through the hardships that they inevitably encountered here. In addition, students evaluated the impact that these newcomers had on the landscape of early urban America by conducting an examination of ethnic settlement patterns in New York City. These ideas were illustrated with authentic representative case studies from particular ethnic and religious groups, period photographs, interactive web sites, and a video that dramatized the life story of one adolescent immigrant boy from Poland.

The GIS activity began by supplying each student with a fictitious immigrant character identity, including his/her name, religion, and country of origin. Each student then had to generate three GIS maps related to the fictitious character’s travels to and settlement in New York City. The three maps illustrate (1) the immigrant character’s point of origin and subsequent journey to the New World, (2) downstate New York counties and their proximity to Manhattan and Ellis Island, and (3) New York City ethnic neighborhood boundaries in 1910 with the fictitious immigrant’s new address shown on the map. Students again used ArcView 3.2, the GIS program owned by the school, to create these maps.

Table 2 - GIS & Immigration

	<b>Description</b>	<b>Goals/Objectives</b>	<b>GIS skill level</b>
Map 1	Journey to America	Understand the distances traveled by immigrants from point of origin to NY City; understand time it took to travel.	Beginner - Carry over skills learned in basic Underground Railroad project
Map 2	Learning Downstate	Employ fundamental place-name geography to help upstate students learn the counties that make up downstate.	Advanced Beginner - manipulation of drawing tools and symbols window
Map 3	Ethnic	Demonstrate potential	Intermediate -

	Neighborhoods	problems with proximity between ethnic groups; Understand settlement patterns by ethnicity	Incorporates work with Census Bureau's TIGER files
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## Conclusion

Today's public school teachers contend with a wide variety of new demands including high stakes state and federal assessments. Information teachers do not perceive as absolutely essential is hence eliminated from their daily teaching. Social studies teachers in New York identify the history curriculum as essential (Palmer-Moloney and Bloom 2001, 641-642). We believe that the way geography can survive this turn of events is to give it an integral role in supporting the history curriculum standards. As a by product, a wider population of learners are reached by harnessing their spatial intelligence through the incorporation of GIS technology.

Infusing middle level social studies classrooms with GIS-based activities provides an avenue by which young students are introduced to geospatial technology. Today's public school students do not typically encounter GIS technology before college or even in graduate school (Alibrandi and Palmer-Moloney 2001).<sup>5</sup> The GIS modules presented here allow students to gain exposure to technology that may have practical application to future careers.

Successful transfer between spatially-based performance and performance on standardized tests remains to be empirically validated. What we do know is that the possibilities for developing social studies modules based in GIS technology are endless.

## Notes

1. Someone with little artistic ability in modern Western culture is not designated as disabled in any way. However, individuals with limited linguistic and logical/mathematical intelligences are typically categorized as learning disabled.
2. The *No Child Left Behind Act* requires that states use science, math and English language arts as indicators of achievement. This leaves geography in an even more tenuous position. Emphasis on reading and writing in social studies classes to support English language arts requirements implies that an already heavy emphasis in this area will become even heavier.
3. The current NYS standards for learning in the social studies formally confer geography an equal place along side history, economics, history, and government. An abrupt disconnect exists between geography's place in NYS standards and its representation on the NYS 8th grade social studies assessment. Geography is relegated to the role of historical illustration, not as a discrete entity worthy of attention. In the NYS pilot test and in the first three implementation years (2001, 2002, and 2003), no questions seriously addressed geographic knowledge, understanding, or applications.
4. Following the presentation of the Underground Railroad module at the 2002 GeoTech conference at Bishop Dunn High School in Dallas, TX, the

module was added to ESRI's ArcLessons available for free download off of the internet site (<http://gis.esri.com/industries/education/arclessons/arclessons.cfm>).

5. Many states, NY among them, have begun incorporating technology standards and requirements into education programs. In addition, schools are recognizing that technology education is most effective when it is applied across the academic content areas. The use of computers in the social studies class is a natural fit. Standard 2, Information Systems, of the NYS Technology Standards requires that middle level students "will access, generate, process, and transfer information using appropriate technologies" (See NY State Technology Education Standards, <http://www.emsc.nysed.gov/ciai/mst/mstls.html>).

## About the Authors

**Elizabeth Bloom** is a social studies teacher at Oneonta Middle School. She works extensively on community-based and hands-on learning opportunities for her students including coordinating a comprehensive service learning program for her school. She is currently on leave and is pursuing her doctorate in Education Theory and Practice at Binghamton University.  
[elizabethabloom@yahoo.com](mailto:elizabethabloom@yahoo.com)

**L. Jean Palmer-Moloney** is an Assistant Professor of Geography at SUNY-Oneonta, where she was awarded the college's prize for Academic Excellence in 2002. In addition to multiple sections of Introductory Geography, Dr. Palmer-Moloney teaches undergraduate courses in Historical Geography, Political Geography, and Urban Geography at SUNY. She has 11 years of experience as a high school geography teacher and is an ESRI certified K-12 GIS trainer.  
[palmerj@oneonta.edu](mailto:palmerj@oneonta.edu)

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Meridian: A Middle School Computer Technologies Journal  
a service of NC State University, Raleigh, NC  
Volume 7, Issue 1, Winter 2004  
ISSN 1097-9778  
URL: <http://www.ncsu.edu/meridian/>  
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last updated: February 1, 2004



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