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Thomas Chandler

Heejung An

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by Thomas Chandler and Heejung An

In the K-12 social studies classroom, the goal is to create the well-informed citizenry that is essential to a functioning democracy. Preparing students for a lifetime of active citizenship is a complex undertaking, one that demands that students be given opportunities to integrate classroom learning with experiential learning in the larger world where political debate and decision making occur (Banks 2003; Parker 2001). Active participation in civic life initiates critical reflection by creating opportunities for students to explore how their new understandings influence their own opinions and beliefs (Dewey 1927). Bransford, Brown, and Cocking (1999) assert that teachers should begin civic education by helping students build trust and cooperation within their community. They also suggest that technologies that enable students to better visualize community issues, learn collaboratively, and discover their role as agents for positive change should be part of social studies classrooms.

A growing body of research suggests that digital mapping systems can play a role in helping students engage with community issues by linking spatial information with map overlays that depict demographic, environmental, and public policy data for the students' communities (Kerski 2003). Social studies teachers who have used digital mapping technology in the classroom point to the unique ability of such programs to display a multitude of digital spatial relationships that cannot be represented easily by printed maps (Alibrandi 2003; Audet and Ludwig 2003). The graphic representation of quantitative data can help students clearly visualize how issues such as urban sprawl, environmental degradation, economic inequality, and changing immigration patterns affect the places where they live. As with any other technology, however, digital mapping programs cannot simply be incorporated into an existing curriculum and pedagogy. In order for these programs to be used successfully in the social studies classroom, curricula must be devised to exploit the full potential of the technology. In this article, we provide a framework within which digital mapping technologies can help make such linkages possible and analyze the ways in which digital mapping can facilitate student learning in social studies.

Technology Integration in the Social Studies Classroom: The Value of Digital Mapping

Students tend to learn about social studies topics in a fairly passive manner, but research indicates that comprehension is enhanced when classroom study is paired with civic experiences (Hahn 2001; Marri 2003). This integrated approach is an essential means both for teaching the strengths and problems of democracy and for providing students with an understanding of its processes (Wenger 1998). The social studies classroom is where education meets the community it serves.

Numerous efforts to introduce technology into this process have not produced meaningful results. More often than not, the incorporation of these digital technologies has only changed the manner in which tasks are accomplished rather than adding significant value to what is taught or learned. As many researchers have indicated, this is in part because the software products currently available to schools do not necessarily match well with the aims of social studies education (Cuban 2003; Whitworth and Berson 2003; Thornton 2004).

Because they help students visualize pressing civil issues in the context of the places that are most meaningful to them, digital mapping programs can bridge this gap. By using transparent overlays, these programs can enable students to examine a far wider range of community relationships than could be accomplished by any other means. Illustrative of this point are the many ways in which students can use

digital maps via free applications, such as Google Maps, to create their own representations of their communities as they see them. This can be accomplished through the insertion of digital photos, hyperlinks, or video linked to specific placemarks on a city map. Taking this concept a step further, Google's Sketch-Up (Exhibit 1) and Street View (Exhibit 2) utilities now make it possible for users to construct three-dimensional buildings and to navigate virtually through many of America's city streets from the perspective of a person on the sidewalk. These interactive elements not only provide meaningful information that was not available in the past but also offer opportunities for learners to identify, engage in, and even help solve community-based problems.

The amount of online data available for digital mapping projects has also increased substantially (Exhibit 3). For example, it is possible for such programs to connect to government-sponsored Web sites, such as the U.S. Census Bureau, where vast amounts of data pertaining to any given community in the United States, as well as many parts of the world, can be downloaded and examined for free. Students can choose specific data to examine and project different data sets onto the same digital map as a way to explore the relationships among various elements of the community or to analyze how larger trends are reflected in their own communities (Exhibit 4). Such exercises can prompt reflection about the student's own role in the community and in the world. Likewise, the University of Virginia's Historical Census Browser is a valuable data source for social studies educators since it contains census data going all the way back to 1790. Such information adds value when viewed in a digital mapping program since it makes it easier to determine how various trends, such as immigration, have shaped public policy over long periods of time.

Using a Digital Mapping Program to Support Critical Inquiry

As noted by Stoltman (2001), for geographic computer programs to be useful and meaningful, they must be used in a way that relates the digital map to real-world experiences, such as comparing a digital map to actual geographic features found in the community. This type of activity, known as *ground truthing*, can best be accomplished via field trips or project-based classroom activities that require students to leave their computer terminals in order to examine the physical world around them. Students can explore and record observations from their local environment and then input their data into a digital mapping program, constructing digital maps of their world. Engaging students in field study in this way offers direct involvement in learning about the surrounding community.

In the process, students may create representations of their communities that run counter to conventional assumptions about a particular place. Descriptors of "gated communities," "trailer parks," or "inner cities" may have little to do with the sense of place associated with a particular locality or the personal aspects of place that can only spring from the experience of living in the community. When students make their own maps, these other aspects of place may be more accurately represented, sometimes in startling ways (Dewey 1916; Mitchell 1963; Noddings 2005).

A community-based curriculum that uses digital mapping can also allow for more social construction, produced by students who have their own particular values and opinions (Whitworth and Berson 2003). When confronted with a new perspective or a new set of data, students can be encouraged to ask critical questions: Where was the information gathered—Hollywood, California, or Hollywood, Florida? When was the information gathered—1965 or 2005? Who collected this information—a public or private entity? Why was the information collected—for commercial or municipal reasons? How was the information collected—through qualitative or quantitative means? What values are enhanced in any given case, and what values are obscured or excluded? The answers to these questions can spark new understandings of the ways in which information is gathered, analyzed, and used (cf. Tufte 1990). It is only after this critical reflection that students may come to realize that most maps are actually very limited representations of reality since it is impossible for a flat video screen or piece of paper to accurately depict the complex, three-dimensional relationships that govern the real world. With this expanded understanding, students can develop a sharper eye in distinguishing the embellished maps so readily found in television commercials and political advertisements

from more credible sources (Monmonier 1996).

Models of Pedagogical Practice

ArcExplorer

While conducting workshops at Teachers College, Columbia University with New York City social studies teachers, Thomas Chandler has noted the creative ways in which these teachers are using digital mapping technologies such as geographic information systems (GIS) to study community-based problems. Their work has been facilitated by a remarkable decrease in the cost of digital mapping software. Not long ago, a single GIS user license cost more than $1,000, but leading software companies now offer free, lightweight versions of their more robust programs. ArcExplorer, a lightweight GIS data viewer developed by the Environmental Systems Research Institute, Inc. (ESRI), is freely available software that provides a straightforward way to conduct a variety of basic functions, including display, query, and data retrieval.

ArcExplorer has been used in several innovative ways. Educators who have participated in Teachers College workshops are now using it to help their students compare and contrast data in order to explore topics ranging from urban planning to disaster preparedness. For example, by superimposing a FEMA flood map over Manhattan, some of the workshop participants have determined the specific locations where a ten-foot storm surge from a category 4 hurricane would cause the most significant flooding (Exhibit 5). Rather than relying solely on public policy experts or the media, they have been able to determine if their own schools and communities are at risk. Perhaps more significantly, they have also considered what they and their students can do to help their community be better prepared while simultaneously questioning the extent to which New York City has an effective plan for dealing with such a megadisaster. Since the New York State social studies curriculum places a strong emphasis on history and geography—both topics are included on the Regents Exam that all students must pass before graduation—ArcExplorer is also being used in Teachers College workshops as a tool to help link past problems to current realities. This can be accomplished by arranging digital maps of the same locale in a chronological sequence to illustrate, for instance, the migration of various immigrant groups at different points in the city's history.

In 1998, in an oral history project at Ligon Magnet Middle School in Raleigh, North Carolina, social studies faculty members and students gathered their own historical data, mapped it using ArcExplorer, and analyzed its relationship to the present. This project began when school alumni who graduated in the 1930s and 1940s—when the school was known as J. W. Ligon High School and served as the high school for Raleigh's African-American students—provided the school with stories, photographs, and artifacts pertaining to the history of the racially segregated community. Students then visited the town urban planning office and the state map archive to obtain paper-based and digital maps pertaining to the community's history. Other data pertaining to the community was downloaded directly from the U.S. Census Web site. As Alibrandi (2003) notes in her description of the project, the 1923–1949 Sanborn fire insurance maps found at the town urban planning office vividly illustrated how segregated the town once was. Some students were startled by the reality this represented while others suggested that little had changed in their community since that time. A comparison of the student-constructed digital maps with the official county-printed maps also led to the discovery of errors in the placement of contemporary streets and landmarks; students then worked with the town urban planning office to update the printed maps. This project clearly met the goals of social studies education, helping students gain a new understanding of their community while also giving them an opportunity to participate in civic life in a very tangible way.

Geocoding and Google Earth

Although it can be interesting to view census data collected by government entities, students may also be interested in plotting their own data points on a digital map, thereby personalizing their viewing experience. In fact, when conducting workshops and seminars, we have noted that the majority of learners—from youth to

senior citizens—are most interested in this specific task since it can help them describe their own journey, story, or understanding of a place in ways not possible with other technologies. This *geocoding* process, which involves the linkage of longitude and latitude coordinates to specified data points, once required the expertise of a professional cartographer. However, it is now possible for social studies teachers and students with little geography background to plot U.S. street addresses on a digital map easily. While free online resources such as BatchGeocode can be very helpful in such activities, the recent release of free *virtual globe* programs—Google Earth in particular—has provided a whole new range of possibilities.

Google Earth allows students to place their own geocoded data on a three-dimensional representation of the Earth's surface (Exhibit 6). These free virtual globe programs also provide students with an engaging means to share and publish their own maps (Exhibit 7). The ultimate products of these online digital mapping projects are *mash-ups*, student-created, shareable maps that combine content from multiple sources into an integrated experience. A mash-up is essentially a collection of application programming interfaces (APIs) streaming from different servers into a central online map. It was once a formidable task to obtain APIs from software companies, but Google Maps, Yahoo Maps Web Services, and ESRI, having recognized the benefits of allowing users to customize their online map interfaces, are now more willing to share their source code. Although such trends may seem trivial to some educators, they are nonetheless important because online mapping is becoming one of the fastest growing vehicles for today's young people to share their ideas, insights, and interpretations of the world they inhabit. The availability of these utilities has democratized the mapmaking process to the point where students are becoming the cartographers of their communities. When these programs are combined with popular social networking Web sites such as Flickr, which allows digital photos to be geocoded to an online map, the possibilities for exchanging and analyzing geographic information expand even further.

One of the most interesting examples of the pedagogical use of Google-generated mash-ups has taken place in an interdisciplinary course at Trinity College (Gordon 2006). In this course, the professor organized students into five groups and assigned them the task of creating mash-ups that mapped out distinctive social spaces within the surrounding community of Hartford. As part of this project, the students were also required to visit these areas of the city in person to gain a fuller sense of how to represent them in their mash-ups. The assignment not only helped students understand their community but also allowed them to become engaged citizens and contribute to the improvement of the city. For example, one group sent its mash-up to the local police and fire departments as an aid for their work; another group used its mash-up to publicize the decrepit condition of local buildings, thereby putting pressure on landowners to invest in the development of their properties. The project of mapping out the community also provided students with ways to participate in their community as informed citizens. While this example does come from a university setting, it offers a model that might readily be adapted to K-12 settings as well.

Implementing Digital Mapping Curricula

A number of resources for integrating digital mapping technology into the K-12 social studies classroom, including software, lesson plans, and other tools, are available online (Exhibit 8). The first step, of course, is acquiring and installing appropriate software. Both ArcExplorer and Google Earth run on PC and Macintosh computers that are less than two years old. For Google Earth, a fast Internet connection, either from a LAN or cable network, is recommended. A teacher considering a digital mapping project should also investigate the availability of some additional hardware; for history projects, a scanner will allow old photographs to be laid over the top of the contemporary landscape, and tools such as GPS devices and digital cameras with automatic geocoding capabilities can be useful in mapping locations whose physical addresses are difficult to determine.

The next step is considering how the software will add value as a teaching tool. A good place to start is by reflecting on the linkages between the school and the local community (Exhibit 9). Field trips are one way to begin mapping the landscape. We have found that touring the community together and collecting addresses

that can be geocoded and plotted on a digital map are frequently productive ways to begin. Once these geocoded addresses are added to a digital map, it is then possible to include multimedia content, such as digital photos, hypertext, audio files, and three-dimensional buildings, to better capture a place's true meaning or significance. Clearly, the possibilities are endless. The challenge is for teachers to integrate technology in a way that engages students in active learning and that encourages them to become involved in their communities.

Conclusion

In his seminal work *Democracy and Education* (1916), John Dewey commented on the danger of failing to establish the necessary linkage between student experience and the surrounding environment:

The classic definition of geography as an account of the earth as the home of man expresses the educational reality. But it is easier to give this definition than it is to present specific geographical subject matter in its vital human bearings. The residence, pursuits, successes, and failures of men are the things that give the geographic data their reason for inclusion in the material of instruction. (248)

According to Dewey, in order for geography to have relevance within the secondary social studies curriculum, it must be conceived as a form of experiential learning in which the student's surroundings become a laboratory for critical examination and discussion (Thornton 2004; Mitchell 1963). Because they allow students to investigate and describe the places with which they are most intimately familiar, digital mapping tools can be a key part of this process across the complete social studies curriculum. The new realizations students make as they map their homes, schools, and other landmarks of their lives can also initiate a recognition of the social, political, and economic realities in societies other than their own.

References

Alibrandi, M. 2003. *GIS in the classroom: Using geographic information systems in social studies and environmental science*. Portsmouth, NH: Heinemann.

Audet, R., and G. Ludwig. 2003. *GIS in schools*. Redlands, CA: ESRI.

Banks, J. 2003. Series foreword. In *Teaching democracy: Unity and diversity in public life*, ed. W. Parker, ix–xvi. New York: Teachers College Press.

Bransford, J. D., A. L. Brown, and R. R. Cocking, eds. 1999. *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press.

Cuban, L. 2003. *Oversold and underused.* New York: Harvard University Press.

Dewey, J. 1916. *Democracy and education.* New York: The Free Press.

Dewey, J. 1927. *The public and its problems.* Chicago: Swallow.

Gordon, J. 2006. Mapping the invisible city outside their walls. *The New York Times*, May 3. A25.

http://www.nytimes.com/2006/05/03/nyregion/03hartford.html?ex=1184212800&en=a856652bd7918f13&ei=5070

(accessed September 10, 2007). [Editor's note: Access to this article requires an online subscription.]

Hahn, C. 2001. Democratic understanding: Cross-national perspectives. *Theory into Practice* 40 (1): 14-22.

Kerski, J. 2003. The implementation and effectiveness of geographic information systems in secondary education. *Journal of Geography* 102 (3): 128-137.

Marri, A. 2003. Multicultural democracy: Toward a better democracy. *Intercultural Education* 14 (3): 263-277.

Mitchell, L. S. 1963. *Young geographers*. New York: Basic Books, Inc.

Monmonier, M. 1996. *How to lie with maps.* Chicago: University of Chicago Press.

Noddings, N. 2005. Place-based education to preserve the earth and its people. In *Educating citizens for global awareness*, ed. N. Noddings, 57-69. New York, NY: Teachers College Press.

Parker, W. C. 2001. Educating democrats: A broad view. *Theory into Practice* 40 (1): 6-13.

Stoltman, J. 2001. Teaching methods in physical geography: Bridging tradition and technology. In *Subject-specific instructional methods and activities*, ed. J. Brophy, 315-347. Oxford, UK: Elsevier Science.

Thornton, S. J. 2004. *Teaching social studies that matters: Curriculum for active learning*. New York: Teachers College Press.

Tufte, E. R. 1990. *Envisioning information.* Cheshire, CT: Graphics Press.

Wenger, E. 1998. *Communities of practice: Learning, meaning, and identity.* Cambridge, MA: Cambridge University Press.

Whitworth, S., and Berson, M. J. 2003. Computer technology in the social studies: An examination of the effectiveness literature (1996-2001). *Contemporary Issues in Technology and Teacher Education* 2 (4): 472-509.