

The Potential of Electronic Atlases for Geographic Education

Available computer technology requires a rethinking of the use of cartographic aids for geographic education. Electronic atlases have the potential to provide a new, exciting medium to promote geographic instruction. They can provide an active, integrative tool to teach geographic concepts and allow processes of higher learning to take place in an innovative, dynamic format. While students are exposed to geographic concepts through electronic atlas use, they also acquire computer skills which will be essential in the twenty-first century.

Throughout the world today, the planning and allocation of resources for economic and social development demands an understanding of global systems. Geographic education is a critical component in fostering this global awareness. In developing geographic knowledge and a global perspective, the ability to make, understand, and use maps is essential (Bartz 1970; Ascov 1974; Jarest 1992; Castner 1987, 1993). To achieve a global perspective and to master geographic thinking, maps can be utilized to depict locations and to describe places; they can be used to illustrate distributions and to explain the interactions of phenomena; and they also can be used to demonstrate movements between places and to organize regions (Pattison 1964). In spite of the basic need to apply maps as tools in their study of geography, students in the United States school systems typically receive little training about map use and map reading (Newell 1986). Few American teachers study geography in their years of teacher preparation. Consequently, methods and sequences for teaching map skills are not well understood, and therefore maps are hardly ever used for problem solving in the classroom. In addition, the maps students are exposed to in the classroom are often meager in number, outdated, or simply dull. Therefore, students often perceive maps as boring or that they have little value in their lives. When taken together, all of these factors contribute to a lack of geographic awareness and lack of interest in geography as a whole (Downs, Liben, and Daggs 1988; Gersmehl and Young 1992; Dymon and Winter 1991).

Under the impetus of the recent Federal mandate Goals 2000, which requires that national standards be developed for seven basic subjects including geography, educators and geographers in the United States are seeking new ways to improve the quality of geographic education (NCGE 1989). They are aware that a fresh new approach to teaching map skills is needed to inform, inspire, motivate, and encourage students (Muir 1985). With the current infusion of computer technology into the schools, one new approach is the application of electronic atlases. They have the potential to provide new excitement in the classroom and to promote geographic education while developing map and computer skills.

The main advantage of an electronic atlases is that it permits students to choose, build, and design maps. These activities support a model of geographic education that assumes that learning about places occurs on

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EDUCATION

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three conceptual levels: (1) concrete images, (2) abstract analysis, and (3) value evaluation (Gersmehl and Young 1992). Electronic atlases can be used as a tool to provide these learning experiences to students.

ELECTRONIC ATLASES

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When analyzing existing electronic atlases, the literature points to three basic types of systems. All three systems have the potential to facilitate learning activities about places while developing map skills. The three basic systems are: (1) view-only systems, (2) creating maps on demand systems, and (3) analytical mapping based on GIS concepts systems (Siekierska and Taylor 1991).

The first electronic atlases produced were view-only systems. An early example is *The Electronic Atlas of Arkansas*. This atlas was to provide timely facts and information about the state to business people, schools, and the general public. It was used like an encyclopedia since its thematic maps furnish an overview of the status of the state of Arkansas. The user simply observes the maps by changing the screen of the computer, either operating a keyboard or using a mouse. This atlas is produced in a similar format as a traditional atlas except it can be viewed on the computer (Smith 1988). One of the advantages of the system is that it allows for timely updates in a cost-effective manner. A K-12 classroom atlas built like this would be most comfortable for the rather traditional teacher or a teacher in the early stages of employing computers in the classroom. Such a view-only system might serve as an introduction to electronic atlases for the very traditional teacher who might move gradually from use of conventional, paper atlases to more innovative electronic atlases.

The next stage in the concept of a view-only system is exemplified by the *Picture Atlas of the World* prepared by the National Geographic Society. This type of atlas exposes the user or potential learner to sound, pictures, and text narratives. The concept of atlas touring, as introduced by Mark Monmonier (1990), is integrated into this atlas. In both of these view-only cases, the user or learner can participate in the decision making only by browsing through the atlas pages, skipping, returning, or moving ahead. Once launched into using computers in their classrooms, American school teachers might be reasonably comfortable with a view-only atlas as an introduction to electronic atlases in the early grades. For the higher level thinking skills and problem solving required of middle school, secondary, and university students, however, more advanced electronic atlas systems are more appropriate.

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More flexible systems of learning exist with the second type of electronic atlas system which allows the creation of maps on demand. Examples of such systems are the *Atlas of New Hampshire and Vermont* (Bayr 1992), the atlas for the Dutch National Physical Planning Agency (Koop and Ormeling 1990), and the new *Interactive Atlas of Georgia* (Institute of Community and Area Development 1994). These systems allow the user or the learner to add, remove, or change data. In addition, the classification scheme and the color code can be changed to create new maps on demand; the system also permits the user to return to the default setting. The system has the advantage that it can be updated after it has been purchased. Since these atlases are menu-operated, it is easy to follow their instructions. Especially important for public education would be the construction of a tutorial to teach school children map elements beginning with points, lines, area, and distorted shapes. An electronic atlas for the elementary classroom might be constructed around the approaches and categories of map learning outlined in the National Council for Geographic Education publication *Map and Globe Skills: K-8 Teaching Guide* (Winston 1984).

The third type of system, such as the *Electronic Atlas of Canada*, goes beyond merely creating maps on demand by providing information retrieval systems as well as analytical capabilities (Siekierska and Taylor 1991). The atlas was designed to supply data in support of decision making within the federal government of Canada. This type of system incorporates Geographic Information System (GIS) functions. Similarly, the *Digital Atlas of Sweden* provides these kinds of capabilities in a menu-operated environment. However, these atlases require some prior knowledge of the topics addressed and an understanding of the system. At this point, these systems are clearly too difficult for the novice operator to operate and to understand. An electronic atlas for teachers and students has to be more simplified without compromising the basic concepts. However, rich possibilities exist for gearing this "layers" approach to information to problems that secondary and university students can endeavor to solve.

The three electronic atlas systems introduced are perhaps only the beginning of a whole new generation of visually powerful cartographic displays in electronic atlas formats. Among the many possible areas of usefulness, they can provide a promising, exciting new direction for geographic education.

One strong possibility, as an example, is the role an electronic atlas might play in teaching concrete images for achieving basic knowledge and comprehension of place (Bloom 1956). Students would focus on what is at a place—its physical and human characteristics (AAG and NCGE 1984). The electronic atlas can display an area on the computer screen, identifying the specific place and setting it in its region. Added sound or explanatory text can provide additional information about the area chosen. Visualization can provide images supporting the geographic message about the physical characteristics of the lithosphere, atmosphere, hydrosphere, and biosphere there. Not only would it explain what is naturally at the place, but it would also illuminate the location's human characteristics, including the population, religions, arts, political system, economic system, languages, etc. It could also present the historical or social changes and issues that exist there. Students would be able to tour and explore the place over time and in relationship to other areas. Compared with the single page maps found in a traditional atlas, the electronic atlas can provide an interactive relationship between the students and the display. The student can use the mouse and click on an area of the map to get additional information about the place, if desired. This would not only provide more comprehensive information about a place, but it would also provide exploration into the past in order to better understand the human interactions with the environment.

At the levels of analysis and synthesis, for example, where students examine why things are the way they are at a particular place, students can use the electronic atlas to explore an area by analyzing a problem and synthesizing information provided in the system to create impressions in map or graph form. These student-created images can be expanded as students gain a better understanding of the topic or as the atlas database creates new concepts through its knowledge-base. Creative students can tap into this knowledge in order to build their own knowledge. These maps could be the mental images of students' understanding of the problem or maps created through available data sources as the result of analysis and synthesis.

Finally, at the evaluation level, students form and study opinions about how things should be at the place in question (Bloom 1956). Here, the

ELECTRONIC ATLASES AS TEACHING TOOLS

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students can take their own analyses and synthesize their information to make the mental connections between the images presented, the text provided, and the theories understood. Electronic atlases can provide a laboratory with which to make these mental connections. This is where students can form their own opinions and evaluate the possible solutions to the problem that they have to solve. Evaluation and problem solving are clearly the heart of geographic education and competency.

Electronic atlases can incorporate Siekierska's three types of learning systems without compromising the basic cognitive activities they offer. Many high school students today are familiar with numerous electronic devices, and some have access to a PC. Others, however, are computer shy and are afraid to turn on a computer. Thus, the development of an electronic atlas for high school and university students offers two advantages: a) introducing computer skills and b) introducing geographic science.

CHANGING CARTOGRAPHY, CHANGING MAPS

The literature points to the importance of map skills to promote geographic competency. It also points to the reality that students in the United States are exposed to boring, uninteresting maps and that they do not perceive maps as having much value in their lives. This adds to the overall decline in geographic knowledge and suggests that a new approach to geographic education is needed. However, rather than merely promoting map use, reading, and analysis from a traditional perspective, this paper suggests that educators should look at the capabilities that electronic atlases have to offer. Electronic atlases have the potential to provide a new map medium for geographic education. Multimedia electronic atlases should be integrated for effective geographic education. Visualizing concepts can provide better and clearer conceptualization of the geographic models than static maps perhaps ever could. With the computer revolution in full swing, cartographers and educators have an opportunity to create "holistic atlases" encompassing far more than the atlas collections of single analog maps of yore. In short, something "new under the sun," in the form of comprehensive electronic atlases could enhance education by illuminating the spatial notions which comprise geography.

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RESUMEN

La tecnología de computadoras disponible, requiere la revisión del uso de los implementos cartográficos para la educación geográfica. Los atlas electrónicos tienen el potencial de proveer un nuevo y excitante medio para promover instrucción geográfica. También pueden constituir una herramienta activa e integrativa para enseñar conceptos geográficos y permitir procesos de mayor aprendizaje dentro de un formato innovativo y dinámico. A medida que los estudiantes son expuestos a conceptos geográficos a través del uso de atlas electrónicos, también adquieren habilidad en las computadoras, las cuales serán esenciales en el siglo veintiuno.

SOMMAIRE

La technologie informatique existante exige que soit repensée l'utilisation d'outils cartographiques pour l'enseignement de la géographie. Les atlas électroniques ont le potentiel de fournir un moyen nouveau et fascinant de promouvoir l'enseignement de la géographie. Ils représentent un outil d'intégration actif de l'enseignement des concepts géographiques et permettent aux processus d'enseignement supérieur de se dérouler sous un format innovateur et dynamique. Alors que les étudiants sont exposés aux concepts géographiques grâce à l'emploi d'atlas électroniques, ils acquièrent par la même occasion les compétences informatiques qui seront essentielles au 21^e siècle.