COMPUTERIZED SIMULATIONS FOR INTRODUCTORY GEOGRAPHY INSTRUCTION

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ABSTRACT

The study of geography is an important component of a university education. Geography is unique among disciplines in its focus on the spatial aspects of physical processes and human actions. Many geographic processes are dynamic, and thus difficult to demonstrate in a traditional classroom setting using static media. At the same time, the manipulation of geographic information by computer has been intensively studied, with many models of geographic processes well understood. Thus, computer simulation of dynamic geographic processes can supplement geography education at all levels of the curriculum. In addition, the use of computer aided instruction allows for decision making and interactive learning by the students.

Members of the Departments of Computer Science and Geography at Virginia Tech are currently working on a multiyear project to apply interactive computer simulations to teaching geography. Our goal is to provide computer-based educational materials for geography that are usable by a wide range of students. Initially we provide a series of computerized laboratory modules applicable to several introductory geography courses. These modules must meet several criteria: 1) They must be highly interactive, allowing students to make decisions and manipulate geographic data in a way that encourages learning while keeping the students' interest. 2) The modules must be easy to understand and highly graphical –

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naive computer users must be able to use them with virtually no training. 3) An effective geography tutoring system must be supported by a Geographic Information System as well as a database system so as to allow for sophisticated manipulation of geographic data, provide tailoring of modules to the geographic location of the class, and to support creation of future modules. 4) The system must run on equipment of as low a cost as possible (under the constraints of the previous criteria). 5) Finally, the modules must relate to the student, i.e., exercises should include real-world data and sufficient flexibility so that the exercise can be done using data for the student's own city, state or country. Based on these criteria, we have designed and are currently working toward the implementation of the following five modules.

Mental Mapping - This module explores the mental maps of students by asking them to locate various places in the world by pointing at positions on an outline map drawn on the computer screen. The computer then warps country borders in relation to errors in placement to show the student's "mental map" of that country.

Nuclear Accident - This module allows the student to explore the consequences of a nuclear accident at any power plant in the world. The module will simulate the movement of the radiation cloud, and then compute the costs to human populations, agriculture, etc. for areas affected by radiation.

Reduction of Commuting Time - This module has the student determine optimal paths for automobile commuters living in the suburbs of a major city to arrive at their work places in as short a time as possible. It allows the student to plan the routes by associating neighborhoods with roads, or creating new roads to reduce bottlenecks. The computer then computes and reports on the success of the student's plan.

Population: International - This module allows students to explore a database to compare countries by population growth, distribution, and density. The student will be able to investigate the effect of changing birth and death rates, fertility ratios, etc. on the population pyramids of selected countries.

Population: Migration and Political Power in the United States - This module allows students to relate migration patterns among counties of the U.S. to data on place characteristics. It simulates past trends in migration among counties based on census data from the 1960-1990 period in the form of animated maps of the U.S. by county that change population categories over time. Those trends can then be extrapolated into the future based on weightings selected by the student. In addition, the module will allow the student to rank counties in a manner similar to that used by "Places Rated Almanac."