Constructing knowledge using GIS in diverse science classrooms

Aida Awad, Amy Bohac, Shelby Childress,
Science Department, Maine East High School, Park Ridge, IL
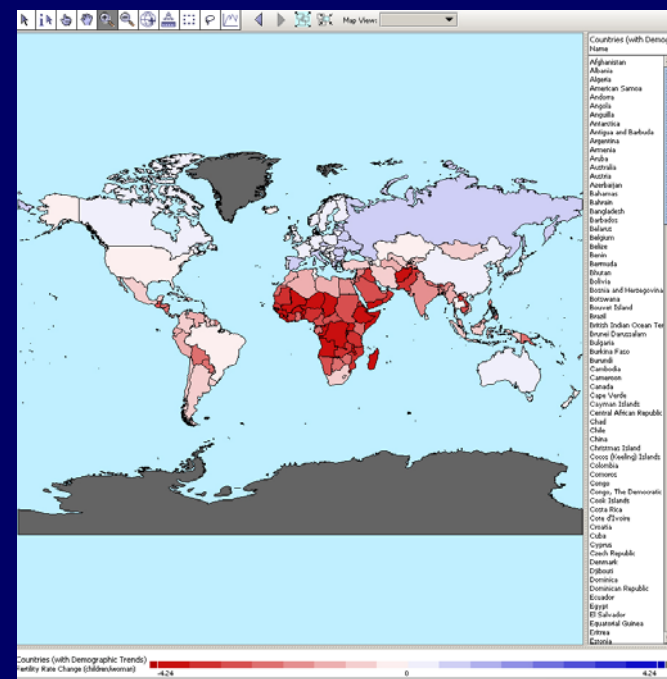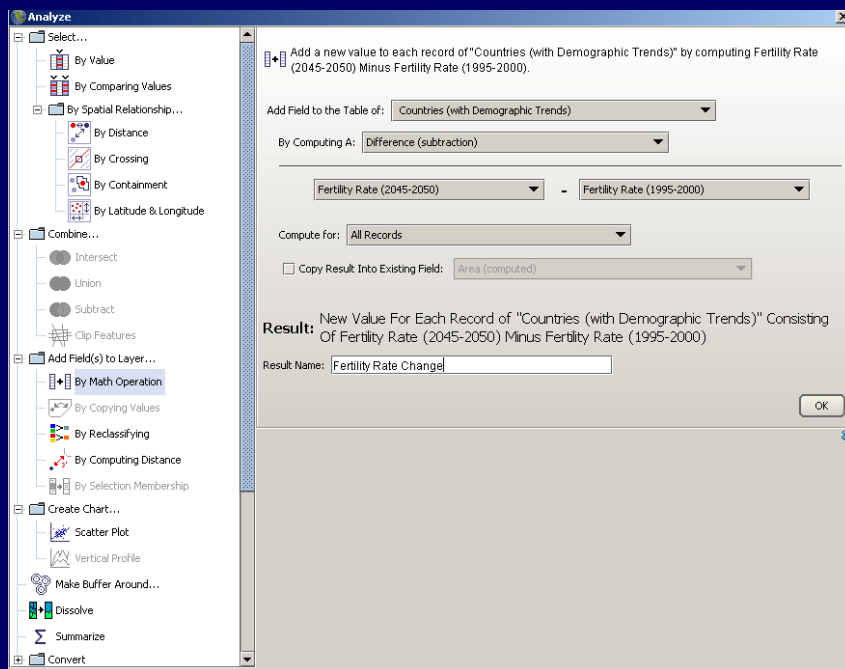
Abstract:

GIS skills are highly marketable and applicable in a wide variety of disciplines. For the past three years, we have been working to integrate rigorous content based lessons utilizing GIS into the science curricula of 11th and 12th grade courses in a diverse suburban high school. The three courses: Geology, Earth Systems Science and AP Environmental Science represent courses offered to a wide range of ability levels. The lessons give students an opportunity to learn GIS skills within a content rich format where students construct their own knowledge through a series of inquiry based activities focusing on real life applications using real data. Student performance was measured with pre / post testing as well as surveys of attitude and experience with the lessons.

The goal of the lessons was to give students inquiry based learning experiences based on relevant issues that are part of the curriculum. Each of the issues could be studied using readily available authentic data, while invisibly integrating GIS skills into the learning experience. None of the students in the three classes had previously been introduced to GIS. Students in AP Environmental Science did a case study to answer the question: *How can you determine if a country is a developing country?* Students in Geology studied the North American water budget as a way to understand the concept of watersheds. Students in Earth Systems Science studied glaciers and glaciation to build core knowledge needed to studying climate change.

AP Environmental Science

Students will use GIS to visualize demographic trends such as percentage of land devoted to agriculture, percentage of the population in urban areas, illiteracy rates, access to sanitation, fertility rates, infant mortality and life expectancy; investigate the difference between developed and developing countries; and, in the end, construct a definition of development and distribute mock funds on behalf of the Foundation for World Improvement.

Analyze

- Select...
  - By Value
  - By Comparing Values
  - By Spatial Relationship...
    - By Distance
    - By Crossing
    - By Containment
    - By Latitude & Longitude
- Combine...
  - Intersect
  - Union
  - Subtract
  - Clip Features
- Add Field(s) to Layer...
  - By Math Operation
  - By Copying Values
  - By Reclassifying
  - By Computing Distance
  - By Selection Membership
- Create Chart...
  - Scatter Plot
  - Vertical Profile
  - Make Buffer Around...
  - Dissolve
  - Summarize
  - Convert

Add a new value to each record of "Countries (with Demographic Trends)" by computing Fertility Rate (2045-2050) Minus Fertility Rate (1995-2000).

Add Field to the Table of: Countries (with Demographic Trends)

By Computing A: Difference (subtraction)

Fertility Rate (2045-2050) - Fertility Rate (1995-2000)

Compute for: All Records

Copy Result Into Existing Field: Area (computed)

Result: New Value For Each Record of "Countries (with Demographic Trends)" Consisting Of Fertility Rate (2045-2050) Minus Fertility Rate (1995-2000)

Result Name: Fertility Rate Change

OK

Table of Layer "Countries (with Demographic Trends)"

Windows

248 Records (of 248)   Find...   Make Selection From Rows   Exchange Rows & Columns   Export...

|	Name	Population (2005) humans	Percent Urban (2000) %	Population Density (2000) humans/km^2	Gross Domestic Product (1999) US$x1000000	GDP Per Capita (1999) US$/person	Improved Drinking Water Acce %
1	Falkland Islands (Malvinas)	2,967					-99
2	French Guiana	195,506					-99
3	Guyana	765,283	38.21	4.29	1,750	2,505	94
4	Pitcairn	46					-99
5	South Georgia and the South Sandwich Islands	0					-99
6	Saint Helena	7,460					-99
7	Suriname	438,144	52.28	2.77	1,392	3,250	82
8	Trinidad and Tobago	1,088,644	74.05	267.84	8,853	7,495	90
9	Venezuela	25,375,281	19.73	31.49	171,982	7,425	83
10	American Samoa	57,881					-99
11	Cook Islands	21,388					-99
12	French Polynesia	270,485					-99
13	United States Minor Outlying Islands	0					
14	Niue	2,166					-99
15	Samoa	177,287	21.67	75.87	475	2,639	99
16	Tokelau	1,405					

Geology

Students will work with NARR water data to investigate components effecting water availability including regional and seasonal data for precipitation, evaporation, infiltration, and surface runoff. Students will develop an understanding of water budgets and watersheds through visualizations of the data using My World GIS 5.0.
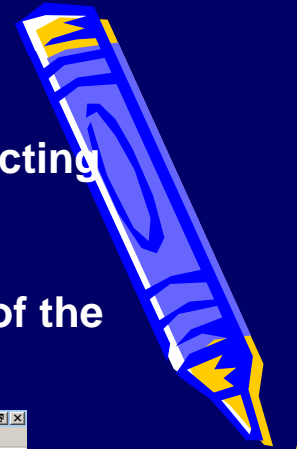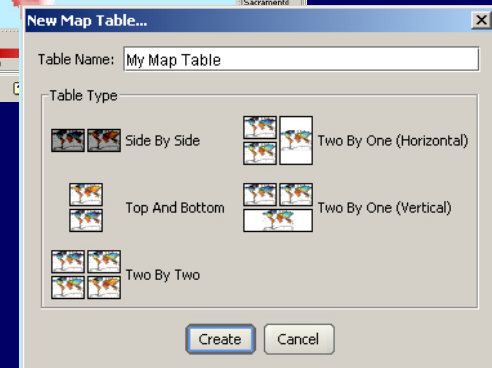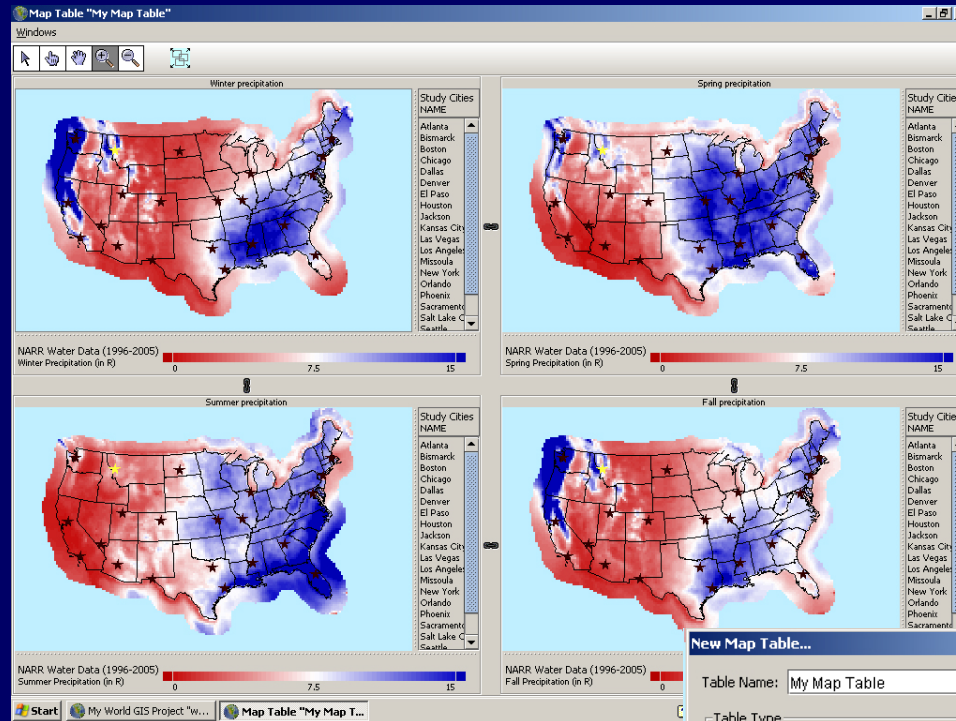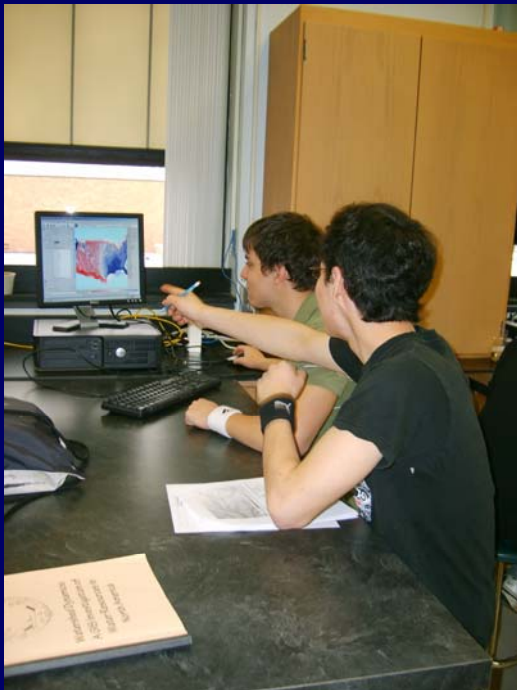
Earth Systems Science
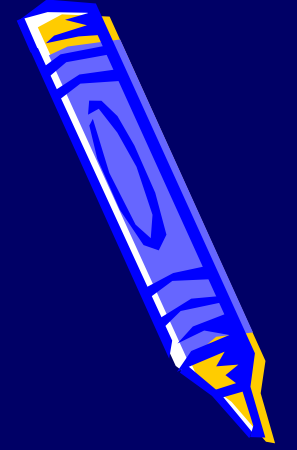
Students in Earth Systems Science used My World GIS to map and graph the correlation between latitude and elevation and glacial type and occurrence. The experience allowed students to construct their own knowledge using data from the National Snow & Ice Data Center as an engaging alternative to a traditional instructional methodology while also learning GIS skills.