Spatial distribution of high school physics teachers in Tennessee

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Introduction

High school physics is one of the least taught academic subjects across the state of Tennessee. In collaboration with Dr. Cahit Erkal, Associate Professor of Physics at UTM, I have researched the location and spatial distribution of high school physics teachers in Tennessee as an indicator of the level of physics education on a county by county basis.

Dr. Erkal needed the information distilled into some form of cartographic output, but producing only a map would not suffice because of the need to tie it to demographic information and other factors, such as the number of students per county and the median household income by county. Therefore, a GIS was needed for storage, retrieval, analysis and displaying information. Using ArcGIS, I created a GIS database of the physics teachers by county in Tennessee and other related data.

Data and methods

Dr. Erkal provided data about physics teachers and classes by school district in the state. I used the information to create a database in Microsoft Excel on the count of teachers, classes and AP classes by district. I obtained a shapefile of the unified school districts in Tennessee from the U.S. Census Bureau Web site and joined the data in my database with the database attached to the shapefile.

After I completed the join, I realized that a number of special school districts in the state did not match up to the county in which they were located. As a result, these districts reduced the effect of the map output, as well as rendered the attempt to join the file to a county map useless. Despite the initial visualization of the distribution of physics teacher using ArcGIS, I could not compare my data with any county-based data to research underlying causes (if any) for why physics teachers are located where they are and why physics classes are taught where they are.

After reworking my database, I summed the data by county instead of school district. This involved finding the counties in which the special districts are located and then adding the data for all districts in a county.

I also included two other fields in my dataset that were not a part of the 2000 Census data available in ArcGIS: median household income and the number of high school students per county. I gathered the information from the Tennessee Department of Education Web site on net enrollment for 2006 and summed the 9-12 grade enrollments by school district. I finally added the data on median household income from each county, based on the Quickfacts portion of the U.S. Census Bureau's Web site, and then joined it to the map of Tennessee counties.

Results

Below are some of the maps I produced based on my database joined to the Tennessee counties map.

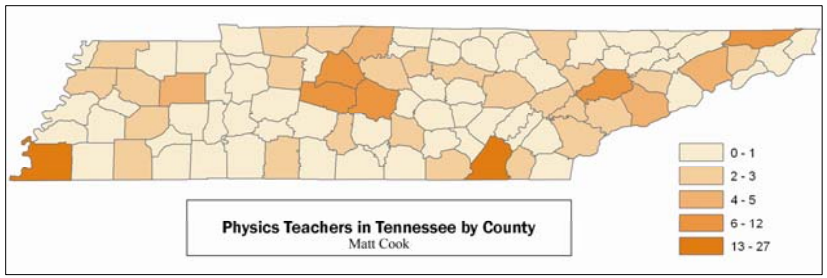


Figure 1. This map was the primary output of my GIS work, to provide Dr. Erkal with a cartographic representation of the distribution of physics teachers in the state. He intends to use this information to share with the Tennessee Department of Education as a part of his efforts to revise high school physics education.

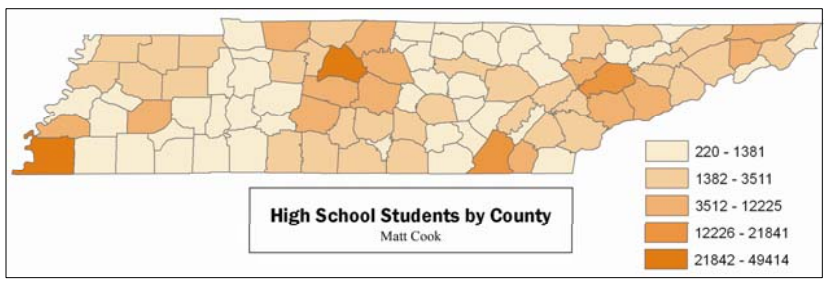


Figure 2. Mapping the total number of high school students by county in Tennessee was used to comparing the distribution of physics teachers and to produce figure 3.

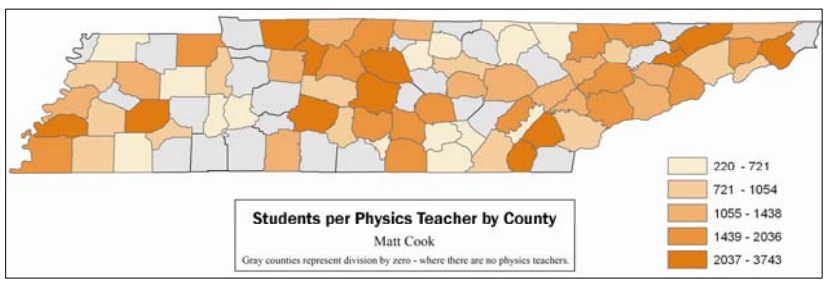
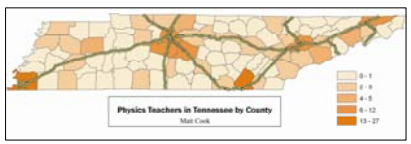


Figure 3. By displaying the data on students normalized by the physics teachers, I produced a map that shows the number of students a physics teacher would be responsible for if all students were required to take a physics class. As the numbers show, one physics teacher in Tennessee is available for everywhere from 220 to 3743 students.

Conclusions

Throughout this project the aim was to build a GIS for physics teachers in Tennessee. During this process, it became apparent that the location of several teachers was correlated to the location of U.S. Interstates. As shown below, particularly in the eastern half of the state, counties with an Interstate are more likely to have physics teacher than the surrounding counties.

As more data becomes available, particularly data on teachers in all disciplines across the state, the GIS of Tennessee physics teachers will continue to improve as new comparisons can be made. This project may be expanded to become a GIS of all high school teachers in Tennessee.



Sources

U.S. Census Bureau. 2007. Unified school districts cartographic boundary files. Internet: http://www.census.gov/geo/www/cob/sn2000.html. Accessed: March 21.

Tennessee Department of Education: K-12. 2006. Net Enrollment spreadsheet. Internet: http://www.tennessee.gov/education/asr/05_06/doc/table8.xls. Accessed: March 30.

Tennessee QuickFacts from the U.S. Census Bureau. 2007. Median household income by county. Internet: http://quickfacts.census.gov/qfd/maps/tennessee_map.html. Accessed: March 31.

Acknowledgments

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For further information

Please contact *mcook@utm.edu* or *cerkal@utm.edu*. PowerPoint and PDF versions of the project are available at www.utm.edu/mcook/physics.

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