Using Geographic Information Systems to Enhance Principles of Macroeconomics Courses with "Real-World" Content

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EXECUTIVE SUMMARY

Geographic Information Systems (GIS) refers to the use of computerized interactive maps that are available for navigation either in the desktop environment or on the internet. These maps can be customized to show any type of spatial data and therefore are applicable to many different educational disciplines. In economics, GIS has the potential of enhancing student interest and knowledge by allowing them to see the economic status of different countries around the world in a highly visual and easy to use format.

During Fall 2006, research was conducted on students in three Principles of Macroeconomics courses to analyze the effectiveness of using GIS as a method of applying economic concepts to real-world situations. Two of the classes formed the treatment (GIS) group and one class formed the comparison (non-GIS) group. Students in the GIS group were exposed to information on interactive maps through three different teaching methods, each involving a unique combination of homework and discussions. The effectiveness of using GIS was evaluated both objectively (using test results) and subjectively (using a student survey).

The following three research questions were answered in the study: Does exposure to interactive maps (GIS) have a negative effect on student performance on traditional classroom assessments? Is GIS an effective tool to teach students the economic status of countries and the interrelatedness of economic variables around the world? Do students attach value to GIS as a method of learning economics?

Question 1 was answered by comparing results of the GIS group and the comparison group on the midterm and the final. Question 2 was answered by assessing student performance on two essay tests with questions specifically relating to the information given on the maps. Question 3 was answered by analyzing results of a student survey given at the end of the semester.

The maps showed country-level information for seven different economic indicators: Gross Domestic Product, Per Capita Gross Domestic Product, Gross Domestic Product Growth, Unemployment, Inflation, Trade Surplus/Deficit Status, and Trade Organization Membership. Each indicator was divided into ranges, and symbolized (color-coded) according to the range. Some of the indicators were symbolized so that more than one could be shown simultaneously. Students could navigate the maps to zoom to different regions or countries, and could drill down into individual countries to see a pop-up table showing the exact values of the indicators.

The three different teaching methods were *Method 1*, which consisted of four classroom discussions, with the teacher doing the navigation in front of the classroom. Six different indicators were discussed, and the entire world was included. *Method 2* involved a homework assignment with students navigating the map, one indicator, and the entire world. *Method 3* included homework and follow-up discussion, two indicators, and information from one continent.

Each class was relatively small (there were 22 students in the GIS group and 16 in the comparison group), therefore results must be viewed with caution. Despite the small sample sizes, patterns emerged in student performance. Student performance on traditional Principles of Macroeconomics content was not affected by the extra time devoted to GIS. An independent-sample T-test showed no difference between the GIS group and the comparison group on either the midterm or final scores. Performance of the GIS group on the essay tests, which asked questions about content shown on the GIS maps, was mixed. The majority of students did not perform adequately on questions related to information disseminated by Methods 1 or 2, but did perform adequately on Method 3 questions.

In self-administered surveys, the GIS group students gave generally positive ratings to the "helpfulness" of GIS in learning economics. On a scale of 1 to 5, with 1 being the least helpful and 5 the most, the mean rating was 3.8. Students attached particular value to being able to compare different countries and see the economic situation of the entire world. They appreciated its visual nature. Some had technical difficulties navigating GIS maps. Of particular interest was the students' report of the helpfulness of Methods 1 and 2, despite the fact that they tested poorly on concepts taught using these methods. Both received positive ratings (3.7 and 3.4, respectively), possibly indicating students' beliefs that they learned more than was demonstrated on the essay tests. Method 3, which correlated to higher test scores, received a higher helpfulness rating of 4.1.

The positive response by students and the effectiveness of Method 3 to disseminate "real-world" information suggest that GIS is a useful teaching tool in Principles of Macroeconomics courses. More research is needed to determine the most effective combinations of homework and class discussion, as well as the optimal geographic range (one or two regions vs. the entire world). Student survey results suggest the possibility of a higher level of student learning than was demonstrated on the essay tests, therefore different assessment methods should also be explored to assure that assessments accurately reflect information retention.