

**USING GEOGRAPHIC INFORMATION SYSTEMS TO ENHANCE
PRINCIPLES OF MACROECONOMICS COURSES WITH “REAL-WORLD”
CONTENT**

@ONE SCHOLAR PROGRAM: 2006-2007

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ABSTRACT

Many instructors face the challenge of broadening student perception to include the “real-world” relevance of traditional course materials. Interactive mapping is one way that students can be exposed to the “real-world” in Principles of Economics (Macroeconomics) courses. Principles courses traditionally introduce students to many different economic theories (such as supply/demand interactions in the marketplace), economic indicators (unemployment, Gross Domestic Product, etc.) and basic definitions. At the Principles level, little attention is given to how different societies perform economically, a subject of interest to many students. With the advent of Geographic Information Systems (GIS) – interactive maps that can show economic indicators in various countries in a variety of combinations – students can easily see the economic status of countries worldwide. This study focused on three aspects of using interactive mapping in Macroeconomic Principles courses: 1) whether using GIS for classroom demonstrations and homework affected student learning of more traditional content; 2) whether use of the maps increased student understanding of the economic status of different countries; and 3) whether the students, themselves, perceived value in the use of interactive maps. Results showed no effect on student performance on traditional content assessments, and a positive level of student-perceived value on use of the maps to understand economics. Use of the interactive maps was found to increase student understanding of the economic status of countries in certain cases. More research is needed to further determine the best method of using interactive maps in Principles of Macroeconomics classrooms.

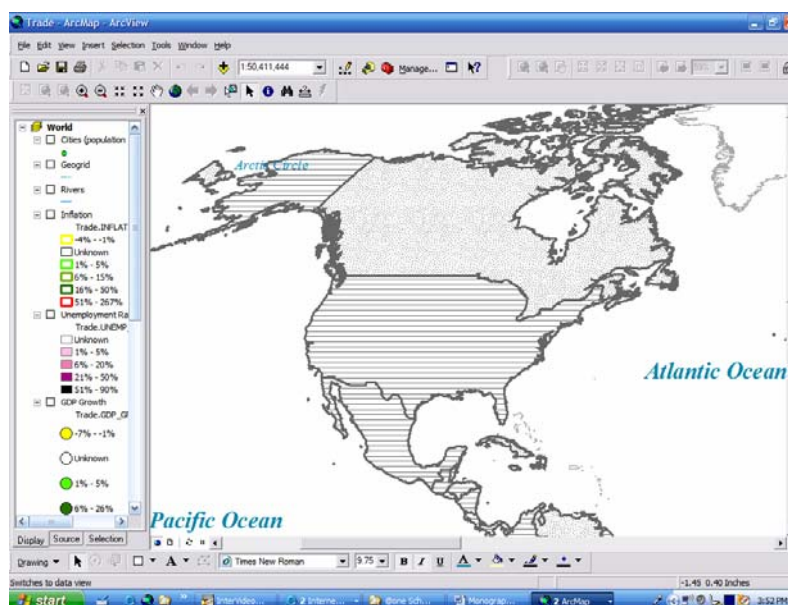
INTRODUCTION

In Fall 2006, students in two beginning-level Macroeconomics courses at Mesa College in San Diego used Geographic Information Systems (GIS) as part of their coursework. The use of GIS was an addition to, rather than a replacement of, their regular coursework. To evaluate its effectiveness as teaching tool, research was conducted throughout the semester, comparing the two classes where GIS was used to one class where it was not used. The following subsections discuss the technology of GIS, the Macroeconomics program at Mesa College, and the importance of the research.

Geographic Information Systems

GIS is a technology that allows for students (and the public) to customize and view maps on the computer. Much of the public is familiar with mapping websites such as MapQuest or Google Maps. Both of those sites use GIS technology to create the maps. A typical map that might be created for a Macroeconomics course would show the trade status of different countries. The screen shot below is a replica of a map showing the trade status of countries in North and Central America.

Figure 1 - Screen Shot of Map



While in some ways this map looks similar to a textbook map, students view it on the computer and are able to extract detailed information from the map. They can navigate it as they please – zooming in on small countries or islands, zooming out to see entire regions or even the whole world. They can select or deselect country labels. They can also drill down if they want to see detailed information on any country.

The computer version of this map also contains information on a variety of other economic indicators (Gross Domestic Product, Unemployment, Inflation, and others), so that students can view information on more than one indicator simultaneously and look for relationships between them.

The Macroeconomics Program at Mesa College

Mesa College is located near downtown San Diego, and has attendance of over 24,000 students annually. Each semester, between 20 and 25 sections of Principles of Economics I (Macroeconomics) are offered. Class formats are on-campus, online, and hybrid. On-campus classes meet two times per week, and may or may not require internet usage. Traditional methods of teaching on-campus courses include the use of lecture, textbook, and overheads or PowerPoint presentations. Online courses, as the name suggests, are entirely internet based. Hybrid courses are a combination of online and on-campus courses. Students in hybrid courses come to campus once a week for a traditional lecture and are assigned internet-based homework and quizzes in place of a second weekly meeting.

Importance of the Research

As a technology, GIS is particularly suited to encouraging students to become personally involved in the theories introduced in their economic textbooks and lectures. Instead of being passive learners, they become actively engaged in the process, navigating the maps to explore countries or topics of interest more deeply, looking briefly at those of lesser interest.

GIS has the ability to assist students in understanding economics in a global context, improving their technology and spatial literacy skills, and offering them opportunities for emotional involvement and practice in critical thinking.

The “globalization of business and communication patterns” (Haigh, 2002) is encouraging many schools of higher education to develop ways to bring a more global perspective into their classrooms. In economics, technology is already recognized and utilized as an important part of Principles courses, primarily for internet research of government statistics or economic news items (Robinson, Davis, 1999). The value of spatial literacy across the K-12 curriculum was extensively studied in 2006 by the National Research Council, which concluded that spatial capabilities are “increasingly important in an information technology-driven society and economy” (National Research Council, 2006, p.10). Finally, research has also shown that the more emotionally engaged students are, the higher the level of learning (Tran and Ward, 2005), and that critical thinking has been shown as a necessary component of economics courses (Greenlaw, S., and S. DeLoach, 2003).

While GIS has the potential to offer all of these components (global awareness, spatial awareness, technology, emotional involvement, critical thinking), as with other teaching tools certain methods of use will optimize its value to students. Using GIS to teach economics (and other non-GIS disciplines) is a brand-new field, and until now little or no formal research has been conducted on optimal teaching methods. This research project considers the effectiveness of different methods.

The research described in this paper specifically addresses global awareness and emotional reaction. Technology and spatial awareness are an unavoidable benefit of GIS, as using GIS involves constant practice of both skills. Critical thinking is a prime area for development in future GIS lessons, but was not part of this research.

Two of Mesa College’s Student Learning Outcomes are directly supported by GIS and this research¹:

*1) **Global Awareness:** Ability to articulate similarities and contrasts among cultures, times, and environments, demonstrating understanding of cultural pluralism and knowledge of global issues.*

¹ <http://www.sdmesa.edu/instruction/slo/pdf/03-04ASdegree.pdf>

By its ability to present a picture of the entire world at once and to allow drill-down and navigational flexibility, GIS gives macroeconomic students a unique opportunity to view and analyze the economic status of the entire globe.

*2) **Technological Awareness:** Ability to understand the applications and implications of technology and to use technology in ways appropriate to the situation. This outcome includes information competency skills.*

GIS is a state-of-the art technology that builds the technological repertoire of all students engaged in its use.

As mentioned above, GIS lessons could also be designed with strong critical thinking components, and if constructed in this manner would also support a third Mesa College Student Learning Outcome:

*3) **Critical Thinking:** Ability to analyze problems, conceptualize theses, develop arguments, weigh evidence, and derive conclusions. This outcome includes both inductive and deductive logical reasoning and methodological processes.*

The connection between spatial analysis (GIS) and critical thinking has been well documented in a recent study by the National Research Council, which states that “spatial thinking [is] an integrator and a facilitator for problem solving across the curriculum”. While the GIS lessons evaluated in this research were not particularly focused on critical thinking, GIS is an ideal tool to foster critical thought. The ease with which students can see relationships between different indicators using GIS is a perfect segue into critical thinking discussions or assignments.

II. RESEARCH QUESTIONS AND HYPOTHESES

The purpose of this research project was to determine the usefulness of introducing GIS into Principle-level macroeconomics courses as a way to effectively expose students to “real-world” economics, and to assess whether replacing more traditional content with GIS content would negatively affect student performance on the traditional content.

One comparison and two GIS classes were used for the study (see Appendix 1 for the course syllabus). Three research questions and their related hypotheses were evaluated.

Research Question 1: *Does the inclusion of interactive maps (GIS) negatively affect student performance on traditional content (or content not related to the GIS maps) presented in a Principle-level macroeconomic course?*

Hypothesis 1: *will be no difference on traditional classroom assessments between the GIS group and the comparison group.*

Research Question 2: *Is GIS an effective tool to teach students the economic status of countries and the interrelatedness of economic variables around the world?*

Hypothesis 2: *With interactive mapping students will effectively learn the economic status of countries and the interrelatedness of economic variables around the world.*

Research Question 3: *Do students attach value to GIS as a method of learning economics?*

Hypothesis 3: *Students will find GIS useful for learning economics.*

Classroom-based action research was used to evaluate the research questions, meaning that a variety of methods were used, and the value of each method was re-evaluated during the semester to develop new methods. The following section describes in detail the methodology used for the study.

III. METHODOLOGY

Subjects

The students in three Principles of Economics I (Macroeconomics) courses were used for the study. All classes were conducted during the Fall 2006 semester, and were full-length (16 week) courses. One class was assigned to be the “comparison” class, and those students had no GIS exposure. The other two classes were “GIS” classes, and used

GIS throughout the semester. All three classes were taught in the hybrid format so students met in class only once per week.

All three classes were relatively small (the GIS group contained 22 students and the comparison group contained 16) and therefore the results described in this paper must be considered preliminary and not generalizable. The demographics are shown in Table III-1 on the next page.

**Table III- 1
Demographics**

		GIS Group		Comparison Group	
		Count	Percent	Count	Percent
Gender	Female	11	50%	4	25%
	Male	11	50%	12	75%
	No Response	0	0%	0	0%
Age	Under 18	3	14%	0	0%
	18-24	18	82%	11	69%
	25-29	0	0%	2	13%
	30-39	1	5%	3	19%
	40-49	0	0%	0	0%
	50 and above	0	0%	0	0%
	Missing data	0	0%	0	0%
Ethnicity	American Indian	1	5%	0	0%
	African-American	1	5%	1	6%
	Asian-American	0	0%	1	6%
	Filipino	1	5%	2	13%
	Latino	4	18%	3	19%
	White	11	50%	7	44%
	Other	0	0%	0	0%
	Decline to respond	4	18%	2	13%
Income	\$0,000 - \$2,999	1	5%	2	13%
	\$3,000 - \$5,999	0	0%	0	0%
	\$6,000 - \$9,900	1	5%	1	6%
	\$9,901 - \$14,999	0	0%	1	6%
	\$15,000 - \$20,999	4	18%	0	0%
	\$21,000 - \$26,999	2	9%	1	6%
	\$27,000 - \$32,999	1	5%	1	6%
	\$33,000 OR OVER	8	36%	3	19%
	No Response	5	23%	7	44%
	First Generation	Not First Generation	21	95%	15
College Student	First Generation	1	5%	1	6%
TOTAL		22	100%	16	100%

Source: Mesa College Research Department

The GIS group was younger, more female, and reported higher incomes.

GIS Procedures

As mentioned above, this project utilized classroom-based action research, with the goal being the development of GIS lessons that would effectively enrich the economics course for students. During the first half of the semester, students were exposed to GIS by two separate methods (see Appendix 2 for examples of the maps that were used). In *Method 1*, students were exposed to a variety of maps by means of class discussions. On four different days, a GIS map was projected on a screen at the front of the classroom and students discussed the contents of the map while the teacher navigated, showing the data both worldwide and by individual continent. Each of the class discussions lasted from five to ten minutes, and most were dynamic discussions, with many students showing interest. The maps showed the following relationships:

Day 1: Trade Surplus and Deficit

Day 2: GDP, Per Capita GDP, and GDP Growth

Day 3: GDP Growth Rate and Unemployment

Day 4: Inflation and Unemployment

Students expressed interest in the maps, and the discussions were enthusiastic. The maps were then transferred to a PowerPoint presentation, which was posted on a website for the students to review before an essay test (given on the same day as the midterm).

In *Method 2*, students were given a homework assignment directing them to a GIS map on the internet, which they could navigate to find out which countries were members of trade organizations, such as NAFTA, WTO, or the EU. The assignment was not discussed as a class.

Students were tested on these two methods in the middle of the semester, during the same day as the midterm, by completing essay questions asking them to describe patterns or relationships of the economic indicators (see Appendix 3 for the exact question wording). They were given a general idea of the type of questions that would be asked and were encouraged to study the PowerPoint maps posted on the internet, as well as the GIS trade-organization map.

Test results showed that, in spite of the enthusiasm with which students discussed the maps, the vast majority had not retained the information well enough to answer the essay questions sufficiently (see Table IV-2). Retention was somewhat better for the exam question related to the homework assignment, but still less than half of the class passed the essay questions.

Method 3 was designed to determine whether the difficulties students had with retention for *Methods 1* and *2* were related to the large amount of information and/or the vagueness of direction on how to prepare for the essay questions. The third method, therefore, consisted of one continent (South America), two indicators (GDP Growth and Per Capita GDP), and both homework and follow-up discussion of the homework. One of the GIS-classes had the follow up discussion as a class, and most students in the other class discussed the homework with the teacher individually. Subsequent test questions on these concepts were very similar to the homework questions. This narrowed scope proved effective, based on the final essay test results.

Evaluation Procedures

Each research question was answered with different evaluation tools, discussed below:

Research Question 1: *Does the inclusion of interactive maps (GIS) negatively affect student performance on traditional classroom assessments?*

To answer Research Question 1, results from the midterm and final were analyzed for the GIS and comparison group, using independent sample t-tests. Both the midterm and final were closed-book multiple-choice tests taken from a test-bank created by the publisher. They contained no questions related to the interactive maps. The midterm had 20 questions, and the final had 80 questions. It is worth mentioning, although not believed to affect the results, that the GIS group accessed the midterm and final using a computer, and each got a different test, as the questions in the test bank were randomized. No computers were available for the comparison group, so a random test was printed from the test-bank and handed out to the students. All students in the comparison group, therefore, had the same questions.

Research Question 2: *Is GIS an effective tool to teach students the economic status of countries and the interrelatedness of economic variables around the world?*

Students were tested for Research Question 2 with essay questions, given on the same days as the midterm and final tests (see Appendix 1 for copies of the essay tests). The midterm essay questions covered the content and information presented using *Methods 1* and *2*, and the final essay questions covered the content and information presented using *Method 3*. The essay portion of the midterm and the final were each worth ten points, and students were given a choice of answering two out of three questions. In both the midterm and final one question related to the interrelatedness of two variables (such as unemployment and GDP Growth Rates) and the other two only addressed one variable. For the midterm, students could choose to answer any two of the three questions. For the final, all students were required to answer the first question, and could choose one of the last two. Students could receive up to five points for each question, and therefore a total of ten points for the entire essay assessment. The rubric used for scoring the essay questions can be found in Appendix 4.

Students were considered to have met or exceeded a learning expectation threshold if they received at least six out of the ten points possible.

Research Question 3: *Do students attach value to GIS as a method of learning economics?*

To assess the value students attached to GIS, a survey was given on the last day of the semester containing four sets of questions, as described below:

Set 1: The first set asked the value of a variety of teaching tools used throughout the semester, with interactive mapping being among the tools.

Set 2: The second set asked students to rate the helpfulness of the interactive maps in understanding specific world situations.

Set 3: The third set asked students to evaluate the three different methods of using the interactive maps.

Set 4: The fourth set asked open-ended questions related to students' specific likes, dislikes, and value that they assigned to interactive mapping.

For the first three sets, mean scores were calculated to assess the results. The written responses to the fourth set were categorized and frequency tables were run. A copy of the survey form can be found in Appendix 5.

IV. RESULTS

Results are presented for each research question separately. Readers should be cautious when generalizing the results due to the small sample sizes (there were 22 students in the GIS group and 16 in the comparison group). As with any classroom research study, a random assignment cannot be made.

Research Question 1: Does the introduction of interactive maps (GIS) negatively affect student performance on traditional classroom assessments?

The GIS group and comparison group took similar midterms and finals. The number of questions was the same, and the tests were randomly generated from the same test bank. None of the questions had any references to the information learned on the interactive maps.

Table IV-1 displays the average score for both groups on the midterm and the final. Review of the table shows that the performance of the two groups on the midterm was similar. The comparison group slightly outperformed the GIS group on the final, however, the independent sample t-tests revealed no significant differences between the two groups on either the midterm ($t(27)=.333, p=.741$) or the final ($t(29)=-1.732, p=.094$).

**Table IV- 1
Mean Scores on Midterm and Final**

	Midterm			Final		
	n	Mean	Std Deviation	n	Mean	Std Deviation
GIS-Group	22	14.86	2.95	18	26.39	5.19
Comparison Group	16	14.50	3.80	13	29.62	5.01

Research Question 2: Is GIS an effective tool to teach students the economic status of countries and the interrelatedness of economic variables around the world?

The assessments used in Research Question 2 consisted of two sets of essay questions, given on the days of the midterm and final. Grading was rigorous, and students were considered to have met the threshold if they scored at least six out of ten points.

Table IV- 2
Threshold Achievement with Different Methods of Mapping Exposure

	n	Percent Meeting or Exceeding Threshold
Method 1	22	18%
Method 2	13	46%
Method 3	17	76%

As shown in Table IV-2, above, with *Method 1* (multiple class discussions, six economic indicators, entire world, general study instructions) less than one quarter of the students met the threshold (and some students referred to a non-GIS assignment on Zimbabwe as part of their answer, possibly inflating the score slightly). The number jumps to almost half with *Method 2* (homework, one economic indicator, entire world, general study instructions) and to over 75% with *Method 3* (homework and either personal or class follow-up discussion, two economic indicators, one continent, specific study instructions).

Some of the essay questions asked students to describe the performance of individual indicators, and some asked them to discuss the interrelatedness of two indicators. Table IV-3 shows the results of the two types of questions by instruction method.

Table IV- 3
Threshold Achievement on Individual Indicators and the Interrelatedness of Indicators

	Essay Question	Percent Meeting or Exceeding Threshold	n
Individual Indicator Question – Method 1	Midterm Q-3	28%	18
Individual Indicator Question – Method 2	Midterm Q-1	46%	13

Individual Indicator Questions – Method 3	Final Q-2 and Q-3	76%	17
Interrelated Question - Method 1	Midterm Q-2	8%	13
Interrelated Question – Method 3	Final Q-1	76%	17

Method 1 results show that students performed poorly on all questions, however their ability to answer the more basic questions about one indicator was over three times greater than their ability to answer questions related to the relationship between two indicators. As mentioned above, this difference may be exaggerated by the fact that one of the questions in *Method 1* had overlap with a non-GIS class assignment on hyperinflation in Zimbabwe, which could have inflated scores on the individual indicator question. With the use of *Method 3*, the students' abilities to answer the two types of questions were equally high.

Research Question 3. *Do students attach value to GIS as a method of learning economics?*

Student value was assessed by a survey given to the students on the last day of class. To evaluate students' interest in the class, they were first asked directly how interesting they found the class overall. On a scale of 1 to 5, with 1 being not at all interesting and 5 being very interesting, students rated the class 3.8. As described in the methodology section, students were given four separate types of questions in addition to the overall interest question: *Set 1*) Helpfulness of a variety of teaching tools; *Set 2*) Specific helpfulness of mapping; *Set 3*) Level of learning from the different methods; *Set 4*) Likes and dislikes about mapping.

Table IV- 4
Set 1 Questions
Student Ratings of Teaching Tools
N=18

On a scale of 1 to 5, where 1 = Not at all helpful and 5 = Very helpful, please rate how helpful the following activities were to your understanding of economics:	Mean	Std Deviation
The newspaper articles and the discussion of them	2.9	1.2
The interactive maps and the discussion of them	3.8	1.1

The take home assignments and discussion of them	3.8	1.0
APLIA*	3.8	1.3
The chapter reading	4.2	0.7
The lecture	4.5	0.7

*APLIA is an online homework program primarily devoted to graphing

Questions in *Set 1* were designed to assess the value students placed on GIS in comparison to other teaching activities. Lectures and reading, the most traditional forms of teaching, were rated the highest. Of the four supplementary activities, interactive mapping was rated at the same level or higher than the other three methods.

Table IV- 5
Set 2 Questions
Student Ratings of Interactive Mapping Helpfulness
N=18

On a scale of 1 to 5, where 1 = Not at all helpful and 5 = Very helpful, please rate how helpful the interactive maps were for:	Mean	Std Deviation
Understanding more about the overall economic situations of different countries or regions of the world	4.1	0.9
Understanding the difference in the economic situations of different countries or regions of the world	4.1	0.9
Understanding how different variables (inflation, unemployment, GDP, etc) interact in the real world	3.7	1.0

When asked to rate specific areas of helpfulness, all three areas were rated positively. Students rated understanding economic situations of the countries around the world overall, and understanding differences the highest. Slightly lower was the understanding of interrelationships between different economic indicators. Ratings on this question correspond with the test results shown in Table IV-3, where scores were higher for questions dealing with only one variable.

Table IV- 6
Set 3 Questions
Student Ratings of Map Assignment Helpfulness
N=18

On a scale of 1 to 5, where 1 = Learned very little and 5 = Learned a great deal, how much did you learn from each of these methods?	Mean	Std Deviation
Looking over maps as a class to learn about a number of different economic variables	3.7	0.9
Homework assignment only (to learn about trade blocs in different parts of the world)	3.4	0.8
Homework assignment with follow-up discussion (to learn about GDP and GDP Growth in South America)	4.1	0.8

Students perceived that they learned the most from the assignment that contained both homework and follow-up discussion, a perception that was verified by their test scores (see Table IV-2). The fact that the homework assignment with follow-up discussion only required students to absorb information from one continent, rather than the entire world, might partially account for their confidence in this method.

Students were also asked three open-ended questions, where they could write in any response. The responses were categorized, and each response assigned up to two categories.

The first question asked “*What did you like most about the interactive mapping activities we did this semester?*” Twenty responses were received, and almost half (nine out of twenty) fell into the “Easy/Visual” category. Students liked seeing the information visually and thought it made the information easier to comprehend. Five out of the twenty liked seeing information for the entire world, two mentioned that it helped them understand economics, and two specifically mentioned that they liked the information button (a tool on the GIS screen that allows one to drill down and see detailed data on specific countries). One student highlighted the ability to compare data, and another liked being able to focus on one country at a time. The table of responses to this and the next two questions can be seen in Appendix 6.

The second question asked “*What did you like least about the interactive mapping activities we did this semester?*” Fifteen responses were received, and seven mentioned that they found the maps either somewhat difficult to navigate or confusing to understand. Two students mentioned that there was too much information to memorize, and two had computer or access problems. One student experienced incompatibility due to using an Apple computer, one wanted more internet maps (*Method 1* maps were not internet-based), and one found the category ranges too broad (for example Per Capita GDP had the same category for all countries in the \$10,000 to \$35,000 range). Finally, one student “liked everything”.

The last question asked “*In general, how did the interactive mapping contribute to helping you learn Economics?*” Out of seventeen responses, nine said the maps helped them compare and learn about countries in the real world. Two students gave a general answer stating that it “helped a good bit” or was valuable. Two thought it didn’t help at all, or at least not very much (but gave no specifics), while two more thought they helped some or were “OK” (again with no specifics). One student mentioned that it was helpful to see graphics rather than text, and one thought the maps were interesting but not necessary.

This last open-ended question most directly addresses Research Question 3 (*Do students attach value to GIS as a method of learning economics?*), and shows that most students found value in the maps. Of the seventeen responses given, only three said interactive mapping gave no contribution to learning economics, and only two more gave it a minimal value.

V. SUMMARY OF RESULTS

Research Question 1: Does the inclusion of interactive maps (GIS) negatively affect student performance on traditional classroom assessments? Hypothesis 1: There will be no difference on traditional classroom assessments between the GIS group and the comparison group.

Results of an independent-sample t-test verified Hypothesis 1, showing that introducing GIS into the classroom had no impact on traditional test results. There was

no difference in performance between the comparison and GIS groups on non-GIS assessments.

Research Question 2: *Is GIS an effective tool to teach students the economic status of countries and the interrelatedness of economic variables around the world?*

Hypothesis 2: *With interactive mapping students will effectively learn the economic status of countries and the interrelatedness of economic variables around the world.*

Hypothesis 2 was supported under certain conditions. Specifically, students learned the status of economic variables effectively when given information regarding one continent (as opposed to the entire world); two economic indicators; using both homework and follow-up discussion as learning tools; and having assessment questions similar to the homework questions.

Research Question 3: *Do students attach value to GIS as a method of learning economics?* **Hypothesis 3:** *Students will find GIS useful for learning economics.*

This hypothesis was supported, with twelve out of seventeen students reporting ways in which interactive mapping helped them to learn economics, and only three reporting it did not help at all. Students placed particular value on the ease with which interactive mapping helped them compare countries and see the “real-world”.

VI. CONCLUSIONS

This research demonstrated the potential usefulness of GIS as a tool for teaching economics, both in objective test results and subjective student evaluations. Some interesting comparisons can be made between student perceptions and test results. First, student survey results implied a higher level of learning than was shown in their test results. Test results show the majority of students failing GIS questions on information given by *Methods 1* and *2* (see Table IV-2). However in the student survey, students gave better than average ratings when asked how much they learned by those methods. Students also reported *Method 2* (homework only) as the method in which they learned least, but test results show well over twice as many students passing questions on *Method 2* than on *Method 1* (classroom discussion only).

Objective test results showed a clearly increasing trend in effectiveness from *Method 1* to *Method 3*, but no definite conclusion can be drawn from the current research

as to what changes caused the improvement. Each instruction method contained variations in the type of dissemination (class discussion only, homework only, homework and follow-up class or personal discussion), geographic area (entire world or one continent), number of economic indicators (one, two or six), and homework/test question similarities.

While further research is needed, this preliminary research shows that when effectively integrated into instruction, GIS can help support student learning of macroeconomic concepts.

VII. IMPLICATIONS

Future Research

Utilizing GIS to teach economics is in its infancy and developing ways to maximize its potential will continue to be a learning process. This research shows the value of using interactive mapping to teach economics, both in test results and student perceptions. Future research is needed to determine more precisely the effectiveness of different types of GIS teaching methods. Lessons that vary in only one respect (such as geographical area covered or homework/class discussion requirements) should be evaluated and larger sample sizes are needed.

Also, other assessment methods should be researched. In this project, students perceived a higher level of learning than their test results indicated, suggesting the possibility that the assessments did not accurately reflect the level of learning.

Classroom

The advent of many kinds of technologies offers students opportunities that have never before been possible, and GIS stands as a shining star among those technologies. Most teachers place a high value on helping students understand the relevancy of economics. While textbooks commonly give a limited amount of global information with the use of bar charts or graphs, the use of GIS gives the instructor the capability of helping students understand the global economic picture without taking an inordinate amount of time away from other Principles content.

More and more internet-based maps are becoming available, giving teachers with no GIS training the opportunity to develop lessons that use interactive mapping to give their students an expanded view of economics, generating in many students a new-found understanding of the importance of economics to their everyday lives.

VIII. REFERENCES

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Robinson, William; Davis, James E., *Technology, the Economics Profession, and Pre-College Economic Education*, *Journal of Education*, v181 n3 p77-90 1999

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APPENDICES

Appendix 1 - Course Syllabus

Welcome to Econ 120! I am looking forward to having you in class! You are about to embark on one of the most exciting learning journeys you will experience in life - economics is one of the most important and interesting classes you will ever have the opportunity of taking!

Does that surprise you? Consider the following:

- Economics is a behavioral science - the study of human behavior. What can be more interesting than figuring out more about how *your* species behaves?
- The behavioral science of economics assumes people are rational in every decision! Do you believe a drug addict is behaving rationally? You're about to find out...

In this class you can expect to work hard, have lots of fun, engage in lively discussions, and practice a new and useful way of evaluating the behaviors of people all over the world!

Instructor: Becca Arnold
Phone: 619/388-2251. Telephone is the slowest way to contact me, and should be used ONLY during my office hours, or to leave messages about class absences. Telephone messages sent throughout the week will be returned during my office hours.
E-Mail: Please email through WebCT. If for some reason WebCT is down, then use rarnold@sdccd.edu. Email will be read and responded to a minimum of one time per day Monday through Friday. All attempts will be made to read/respond in the early afternoon. Email is not checked on weekends.

Course Title: Principles of Economics I (Macroeconomics)
Course Number: ECON 120
Class room: K201B
Office Number: Room F207B
Office Hours:

Monday: 2:00 to 5:00 PM

Wednesday: 8:00 to 9:00 AM; 12:30 to 2:00 PM

If possible, please let me know ahead of time that you are coming, so I will be sure not to schedule an appointment with another student.

Also, other times can be arranged if necessary.

Mailbox: My mailbox is located right around the corner from my office. Walk into F207, take the first left, and you will see the bank of mailboxes.

Textbook:

1. Irvin B. Tucker

Macro Economics for Today - Alternate Version with *Aplia passcode*

ISBN #: 0-324-41575-3 (If you buy a new textbook from the bookstore or KB books, you will have the passcode; if you buy a used textbook, you can buy a passcode separately at the bookstore BUT IT'S MORE EXPENSIVE THAT WAY. You can also go to econ.aplia.com (there is no "www") to purchase either just the passcode, or both the passcode and a hard-copy book.

NOTE: APLIA does not require payment for 3 weeks if you just sign up for the passcode and e-book (an e-book comes automatically). Therefore, even if you are waiting on financial aide or a paycheck, sign up for APLIA immediately. Then you have access to both the e-book and the homework assignments and can proceed in the course from the beginning.

NOTE NUMBER TWO: A few students only get APLIA and then use the electronic book. HOWEVER, because you are required to bring your book to class, this has only been cost effective for those students who can print out chapters for free.

Required Supplies (bring to each class):

Textbook

Graph Paper

Pencils (not pens)

CHEAP Calculator (must be approved by instructor). NOTE: You cannot take tests with a calculator that is not approved, and VERY CHEAP.

WebCT: (<http://webct.sdccd.net>)

Quizzes are taken through Mesa's online program, WebCT. Additionally, all course documents and grades are available on WebCT. Students are automatically registered in my class, with a user name that is your student ID and a password that is your birthdate in MMDDYYYY. Go to www.sdccdonline.net and follow the instructions from there.

WHAT'S A "HYBRID" COURSE?

You have enrolled in a "hybrid course". A hybrid course is unique, in that students attend class one day per week, and engage in internet work for the equivalent of the other day. Hybrid courses have the same expectations for hours of homework, etc. as traditional courses.

THE COURSE IN A NUTSHELL:

How you will be graded:

Chapter Packets (20 points each x 14 packets)	280 points
Reading Chapter before class	20 points
Attendance and class participation	20 points
Midterm	40 points
Final	80 points
TOTAL	440 points

What you need to do before class each week:

Read the chapter we are about to cover (there will be a quiz)
Complete the chapter packet, which contains four items: <ul style="list-style-type: none"> • Printout showing your online homework was done correctly • Printout showing your online quiz was passed with 8 or more correct • Newspaper article and one paragraph summary • Take home assignment

How much time you can expect to spend:

Class time	1 $\frac{1}{2}$ hours
Online homework assignments	1-2 hours
Newspaper article	$\frac{1}{2}$ hour
Chapter reading and online quiz	2-3 hours
Take home assignment	1-2 hours
TOTAL	5 $\frac{1}{2}$ to 9 hours

Note: Time spent will vary significantly with each student and with the different Chapters. This is just my best guesstimate.

HOW TO COMPLETE A CHAPTER PACKET

Chapter packets are pass/fail. You receive 20 points or zero points for the chapter packets, so please be sure they are complete.

The packet:

1) MUST BE STAPELED (paper clips are NOT accepted)

2) Must be turned in at the beginning of class. If you are late, you lose the opportunity to turn in your packet.

3) Must contain

- Printout showing that you have passed the WebCT Chapter Quiz with a grade of 8 or higher.

You can print this directly from WebCT. You are able to take the quizzes as many times as you need to receive a passing score of 8 or more correct. These can be open or closed-book quizzes. Taking them as closed-book quizzes helps prepare you for the midterm and final.

VERY IMPORTANT NOTE: Although you can take the quiz unlimited times until the due date, you must wait 30 minutes in between attempts, so you have time to study more. So don't try to take the quiz 10 minutes before class starts!

- Printout showing that you have completed the internet APLIA homework for the Chapter with all questions correct.

To get the printout showing that you have completed the homework, follow these steps:

- In APLIA go to the practice problem set(s) for the Chapter.
- Scroll to the bottom of the page.
- Click on SCORE SHEET.
- If you have answered all the questions correctly you should see all 1's in the middle column. Print out that sheet and bring it to me in class. If you don't see all 1's, redo the homework until you see all 1's.
- Complete the above procedure for all of the practice problem sets assigned for the chapter (usually 2 sets, totaling 20 to 30 questions)

Directions on accessing APLIA are at the back of this syllabus.

- Copy of a newspaper article and a one-paragraph typed summary (some weeks there will be special assignments).

You can find economic news in the business section of any newspaper, at many internet sites (Yahoo is a good one). One of the best sources is the radio show

“Marketplace” which comes on NPR (FM 89.5) at 5:30 each evening, and at 6:50 and 7:50 AM. You can hear archives and also printout summaries of the archives (to hand in with your packet) at <http://marketplace.publicradio.org>

Also “The World” which is on NPR from 2-3 each afternoon. You can access the archives and printed summaries at <http://www.theworld.org>

You cannot present news from “rant” radio (most of the talk show radio programs), as this usually is way too biased to have useful information.

This is not meant to be overly time consuming, so you don’t need to know in-depth information about the subject. The headlines and a few facts will be sufficient. Most weeks students will be able to bring in an article on whatever economic news they wish, but occasionally a specific topic or news source will be assigned.

- Take-home assignments.

The purpose of the take home assignments is to give students practice in understanding how the concepts relate to the real world. Most of the assignments require access to the internet. These assignments are not graded for correctness, but for effort and presentation. At the back of this syllabus is the “rubric” which shows how I will grade the take home assignments

Take care with these assignments, as doing them poorly can cause the entire packet to be rejected.

VERY IMPORTANT NOTE! THE FOLLOWING PROBLEMS WILL CAUSE A PACKET TO FAIL:

- 1) Not all of the 4 parts are submitted
- 2) All homework problems were not done correctly
- 3) The quiz was not passed with a grade of 8 or higher
- 4) The packet is not stapled (paper clips are NOT acceptable)**
- 5) The news article summary is not formatted correctly or of sufficient length (5 sentences minimum)
- 6) The take-home assignment is not sufficient (see rubric at the back of this packet).

In most cases, failed packets **cannot** be fixed and resubmitted, but can be replaced with a packet on Chapter 18, which is not covered in class. Those who don’t fail a chapter can use Chapter 18 for extra credit.

READ THE CHAPTER BEFORE CLASS (20 POINTS)

You start the semester with a full 20 points, but lose 4 points each time you cannot answer simple questions about the chapter, which are asked BEFORE the lecture.

Students will be called on at random to answer the questions, which can easily be answered correctly if the Chapter was read with attention.

If you have an unusually strong fear of speaking in class, let me know and I can quiz you privately before each class session. This must be arranged at the beginning of the semester.

ATTENDANCE AND CLASS PARTICIPATION (20 POINTS)

Students start with 20 points. 2 points are lost for each absence, excused or non-excused, for each tardy, or for not actively participating in class. An absence or tardy will also cause 4 points to be taken off the "Read the Chapter before Class", if you were randomly called on to answer the quiz question but were not present to attempt it.

The lectures in this class are "active" lectures, meaning I will ask lots of questions of the students. If called on, you are not required to know the answer, but if you don't, you are expected to have a good attitude and make a reasonable attempt to figure it out. If I call on the entire class, you are expected to either have your hand raised (if you know the answer) or to be flipping through the book or your notes (if you don't). A student not actively participating loses 2 points each class.

TESTS - 120 points

A closed-book midterm will be given worth 40 points. A closed-book final will be given worth 80 points. They are comprehensive, and pull from the same test question database as the chapter quizzes, with the possible addition of two to three essay questions.

EXTRA CREDIT:

Students are welcome to do 40 points of extra credit. Below are some ways to do extra credit. Other opportunities will be offered throughout the semester.

- Complete and turn in a packet for Chapter 18 (ask me for an applicable take-home assignment).
- Answer the Questions in one of the YOU'RE THE ECONOMIST or INTERNATIONAL ECONOMICS sections in the Chapter

In general 3 to 4 points are awarded for each extra credit assignment. **ONLY ONE ASSIGNMENT CAN BE TURNED IN PER WEEK** and none on the day of the final.

GRADING:

- A: 90% or higher
- B: 80 - 89%
- C: 70-79%
- D: 55-69%

F: Less than 55%.

Keep reading. We're almost done! And it's all super-important info!

Attendance:

Mesa attendance policy dictates that if you miss over 10% of the coursework with UNEXCUSED absences, you must be dropped from the class. We only meet one time a week. That means, for this class, you will be dropped ON YOUR SECOND UNEXCUSED ABSENCE!!!

Read on to see how to excuse an absence:

An absence *MUST* be excused before class, except in the direst of circumstances, in which case you will likely be asked to present written proof of your inability to contact me before class. Most of you have cell phones, so even a car accident on the way to school can be reported before class. Also, arriving late (after I have taken attendance) or leaving early is counted as $\frac{1}{2}$ an absence.

Disabled Students:

If you have a disability that may cause you to need academic accommodations, please discuss this with me sometime during the first two weeks of class.

Expected Classroom Behavior:

Professional, adult behavior is expected of all students at all times. Students will be dropped from the class, referred to the Dean of Academic Affairs, and/or receive a lowered grade if they engage in behavior that is disruptive to other students or the instructor. A partial list of disruptive behaviors includes:

- Talking to other students (even in low tones of voice)
- Passing notes to other students
- Cell phone use (or ringing of cell phones)
- Eating in class
- Monopolizing the classroom discussions or question periods
- Speaking disrespectfully to others in the classroom
- Leaving and returning during class (use the restroom *before* class)
- Refusing to follow reasonable instructions.

Additionally, students are expected to pay attention at all times. This means

- do not work on assignments for this course or other courses during class-time
- do not read other materials
- do not listen to or play with electronic devices of any kind

Notes cannot be taken on laptops in this class

Basically - do not engage in any activity that takes your attention away from the information being taught in class.

Cheating/Plagiarism:

Neither cheating nor plagiarism are allowed (I bet you suspected they wouldn't be). Cheating or plagiarism on any assignment or quiz will result in an immediate F for the assignment and possible further disciplinary action by the College.

Plagiarism is any one of the following:

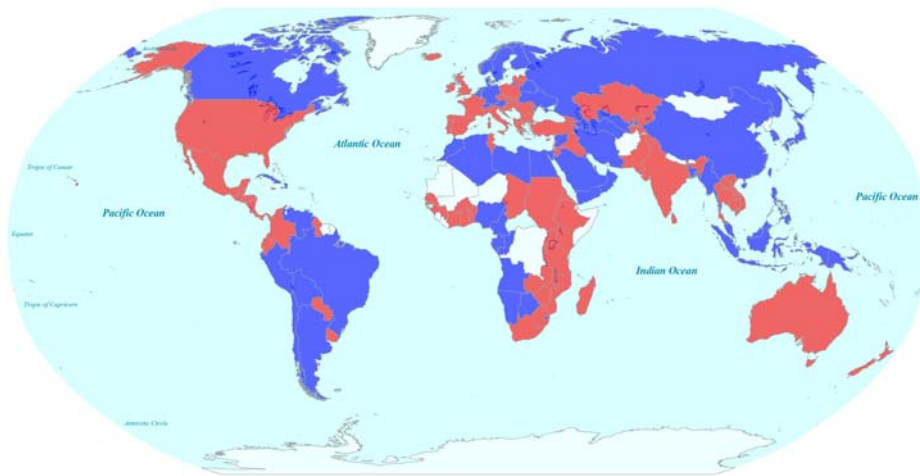
1. Verbatim copying without proper acknowledgment
2. Paraphrasing without proper acknowledgment
3. Putting together a "patchwork" paper from diverse sources without proper acknowledgment of the sources
4. Unacknowledged appropriation of information or of someone else's ideas
5. Turning in assignments that are the same as another student.

If no one shows up to teach...

In the unlikely event that no one shows up to teach class, Mesa policy states that students need only wait 15 minutes. Sounds good I know - but don't count on it happening!

Appendix 2 - Examples of Maps

Countries with Trade Surplus or Deficit – Whole World View



GDP and Per Capita GDP – Asia



Final - Essay Portion - 10 points - Fall 2006 Macroeconomics

ANSWER THE FOLLOWING QUESTION:

Do you see any relationship between GDP growth and per-capita GDP in S. America? If so, what is the relationship?

ANSWER **ONLY ONE** OF THE FOLLOWING QUESTIONS:

1. What ranges of GDP Growth do you see in S. America? Be specific in describing patterns, naming individual countries or areas of the continent.

OR 2. What ranges of Per Capita GDP do you see in S. America? Be specific in describing patterns, naming individual countries or areas of the continent.

Appendix 4 - Grading Rubric for Essay Questions

**Table A- 1
Rubric Grading Criteria**

Question Type	5 points	3 points	1 point	0 points
Questions discussing regional economic performance (such as <i>only</i> GDP or <i>only</i> the unemployment rate)	Meets all criteria listed under good and can name not only regions, but specific countries within regions	Can compare and contrast at least three world regions	Can compare and contrast two world regions	Cannot correctly compare any regions
Questions related to students understanding the interrelatedness of variables (such as GDP's interrelation <i>with</i> the unemployment rate)	Can discuss the complexity of the relationship between the variables, with more than two examples	Can discuss the relationship between the variables with one or two examples. Knows something about the complexity of the relations	Knows in general the relationship of the variables	Does not know the relationship of the variables

Appendix 5 - Student Survey

STUDENT SURVEY

Thank you for filling out this survey. Your responses are completely anonymous and confidential. I will not even look at them until after the grades are posted (lest you are worried about your handwriting being recognized). Your thoughtful responses will help plan future semesters.

1) Overall, how interesting was this class for you? Please rate between 1 and 5, with 1= not interesting, 5= very interesting _____

2) How helpful were the following activities to your understanding of economics:

1= Not Helpful, 5= Very Helpful

a) The newspaper articles and the discussion of them	1	2	3	4	5
b) The interactive maps and the discussion of them	1	2	3	4	5
c) The take home assignments and discussion of them	1	2	3	4	5
d) APLIA	1	2	3	4	5
e) The chapter reading	1	2	3	4	5
f) The lecture	1	2	3	4	5

3) On a scale of 1 to 5, how helpful were the interactive maps for...

1= Not Helpful, 5= Very Helpful

a) Understanding more about the overall economic situation of the world	1	2	3	4	5
b) Understanding differences in the economic situations of different countries or regions of the world	1	2	3	4	5
c) Understanding how different variables (inflation, unemployment, GDP, etc.) interact in the real world	1	2	3	4	5

4. We had three methods of using interactive maps this semester: (a)looking over maps in the classroom, (b)assigning homework only (we assigned homework to learn about Trade Blocs), and (c)assigning homework with follow-up class discussion (to learn about Per capita GDP and GDP growth in South America).

On a scale of 1 to 5, how much did you learn from each of these methods?

1= Learned very little, 5= Learned a great deal

a) Looking over maps as a class to learn about a number of different economic variables	1	2	3	4	5
b) Homework assignment only (to learn about trade blocs in different parts of the world)	1	2	3	4	5
c) Homework assignment with follow-up discussion (to learn about GDP and GDP Growth in South America)	1	2	3	4	5

4) What did you like **most** about the interactive mapping activities we did this semester?

5) What did you like **least** about the interactive mapping activities we did this semester?

6) In general, how did the interactive mapping contribute to helping you learn Economics?

7) Please share any other comments you have about the class: _____

Thank you for your time!

Appendix 6 - Responses to Open-Ended Questions on Student Survey

Table A- 2
Set 4 Questions
Students “Likes” About Interactive Mapping
(Open-Ended Questions)

What did you like most about the interactive mapping activities we did this semester?

Category	Number of write-in responses fitting in each category
Easy/Visual	9
Worldwide Info/Info on different countries	5
Understand economics	2
Compare data	1
Information button	2
Focusing on one country	1

Table A- 3
Set 4 Questions
Student “Dislikes” About Interactive Mapping
(Open-Ended Questions)

What did you like least about the interactive mapping activities we did this semester?

Category	Number of write-in responses fitting in each category
Difficult/Confusing to navigate or understand	7
Too much to memorize/too much information	2
Not MAC compatible	1
Computer/access problems	2
Wanted more internet maps	1
Ranges too broad	1
Liked everything	1

Table A- 4
Set 4 Questions
Student Beliefs About the Contribution of Interactive Mapping
(Open-Ended Questions)

In general, how did the interactive mapping contribute to helping you learn Economics?

Category	Number of write-in responses fitting in each category
Compare/learn about countries/real world	9
General: Helped a good bit/valuable	2
Didn't help/didn't help very much	2

OK/helped some/helped a little	2
Helpful to see graphics rather than text	1
Interesting but not necessary	1