
BRINGING ECONOMIC DATA TO LIFE IN THE CLASSROOM

Ryan T. Phelps, Stephen F. Austin State University
Attila Cseh, Valdosta State University

ABSTRACT

We detail several methods for improving economic instruction through the use of Gapminder World. Gapminder World is a free, simple and engaging internet-based resource for illustrating relationships between key global economic indicators. It presents data in a way that is in line with students' exposure to modern media and its dramatic visual content. The format instantly and intuitively conveys a great deal of information. Real world application and creative presentation are the keys to capturing the increasingly illusive attention and interest of today's student body. This tool can be readily used to energize students' natural curiosity, regarding world events, converting it into genuine motivation to understand economics.

INTRODUCTION

Interest in improving instructional methods in the post-secondary economics classroom has been growing lately. For example, one of the major goals of the Teaching Innovations Program sponsored by the Committee on Economic Education funded by a grant from the National Science Foundation was to promote more interactive learning materials. One reason for this increased interest may be that economics seems to be lagging behind other disciplines in applying non-lecture teaching methods. Economics classes are still primarily taught in the old-style "chalk-and-talk" approach (Watts and Becker, 2008). Since other disciplines have a head-start on economists in implementing more student-engaging instructional methods it is not surprising that one of the things that students mention, years after graduating, about their experience with their economics classes is that they are mostly taught in the old-fashioned way (Allgood et al., 2004).

There have also been recent calls toward making economics courses more rewarding (Hoyt, 2003). These efforts, Hoyt reports, carry benefits for both the instructor and the student. Rewards for the instructor include experiencing "genuine

student engagement” which the author describes as “intoxicating”. Students benefit from application to real world issues which she describes as “a life line to the real world”, and through the creation of “memory hooks” which facilitate in learning. The applications detailed here represent relatively costless methods for achieving these goals. “The cost of using conventional chalk and talk, rather than more contemporary outcome-based methods, may be significant in the long run as students choose to move away from economics and into more lively and interesting classes” (Becker and Watts, 2001).

Students have developed a taste for the internet as a medium of entertainment and education. Today’s college age students grew up with access to personal computers throughout their entire life. They also could easily have had access to the internet for most of their lives. Therefore, students are more willing to welcome multimedia/internet to their learning experience – as early as in the middle/high school years (Pew Internet & American Life Project, 2002a), and using the internet also has positive impacts on college learning (Pew Internet & American Life Project, 2002b). The recent popularity of tools such as Economics in the Movies, Movie Scenes for Economics and MusicForEcon, demonstrate educational gains through entertainment (Mateer, 2005; Movie Scenes for Economics; Music for Econ). For a more complete detailing of the work in this area see Mateer and Rice (2007). The widespread use of and students’ familiarity with the internet have created numerous opportunities to improve upon old methods of teaching economic concepts. “College students today clearly expect the computer to be an important learning tool” (Goffe and Sosin, 2005).

We understand that the use of technology in the classroom should not be a goal in and of it-self. We believe the methods presented here are more empowering to student learning than other available tools. Our beliefs in this regard are supported by our observations, statistical evidence, and student comments. The results suggest that this tool increases student interest in economic issues as well as in the course content and provides real world examples in order to expand their natural curiosity.

Student attitude towards economics has been shown to be a significant determinant of student performance (Karstensson and Vedder, 1974). Also, experiments used in economics courses have been shown to improve both student attitudes and student performance (Durham and Schulman, 2007). While we do not attempt to demonstrate a link between the tools detailed here and student performance, we do offer some limited evidence that they do improve student attitudes toward economics.

Gapminder World, the teaching tool discussed here, provides virtually painless synergy and empowers professors to overcome some troublesome hurdles.

We introduce Gapminder and establish some straightforward “best approach” applications of the tool for economics principles classes.

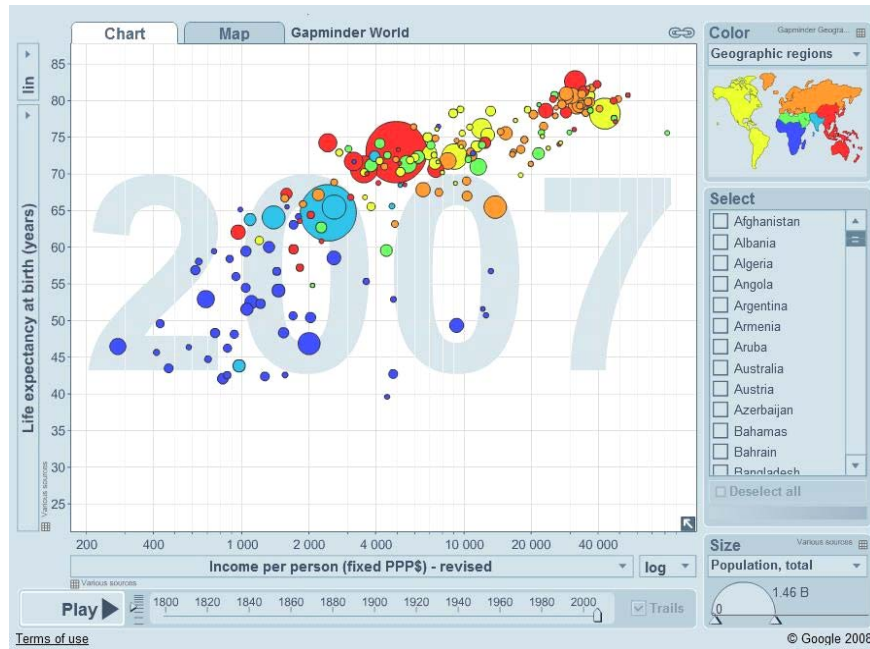
This paper presents non-lecture methods for capturing student attention and interest with economic data using a free internet tool, Gapminder World. We would like to emphasize that Gapminder World is a product developed by the Gapminder Foundation which was founded in Stockholm by Ola Rosling, Anna Rosling Rönnlund and Hans Rosling in 2005.

“Gapminder is a non-profit venture promoting sustainable global development and achievement of the United Nations Millennium Development Goals by increased use and understanding of statistics and other information about social, economic and environmental development at local, national and global levels. We are a modern “museum” that helps making the world understandable, using the Internet.”

Also, this tool was discussed at one of the Technology, Entertainment, Design (TED) conference sessions (For more information see www.ted.com). Shortly after its introduction Gapminder became a hot topic in the blogosphere. We decided to write a paper on its applications in our classrooms when we realized through conversations with colleagues (at conferences and other forums) that it is not as widely known among instructors/educators as we had thought.

Gapminder World is a motion chart, which is a revolutionary way of portraying simple relationships between time series data (www.gapminder.org). As illustrated in Figure 1, Gapminder World presents a scattergram which portrays four variables at once. The default setting portrays life expectancy at birth on the y-axis and income per person on the horizontal axis. Additionally, the size of the dots (indicating each nation) conveys population and the color of the dots indicates geographical region. The variable that drives each of these aspects can be set as desired (Choices include a wide range of key economic indicators). Per person income is Gross Domestic Product (GDP) per capita adjusted for purchasing power parity in 2005 dollar prices. A short description of each variable can be obtained by holding the cursor over the title on the chart. Also, supporting documentation is available through the website.

Figure 1: Gapminder Default Setting



What makes the motion chart different and powerful is its animation of changes in the data over time. Before the historical data can be played forward, the starting point must be selected. The year 1970 is a good starting point due to some wild variations (and fragmented availability) in the data prior to this date. After selecting a starting year and clicking play, the static scattergram becomes animated as the sequential years of data play out the changes in the simple relationship over time.

This paper details four applications of Gapminder World toward improving economics courses. Each application is presented completely, so that each could be used separately as called for in a particular course. There is, however, overlap between the applications so that readers may wish to present several applications at once.

APPLICATION 1: GRAPHS CORRELATION AND MODELS

Even though economists frequently use graphs to teach economic concepts, graphs are not universally well understood by students (Hill and Stegner, 2003). In this application we detail a method for using Gapminder World to illustrate the efficiency of graphs as tools for conveying information. A quick review of basic graphing concepts should, in fact, be included in an explanation of what students are seeing in the static scattergram.

After a quick introduction, students are asked what the dots on Figure 1 and their locations represent. Alternatively, the professor could simply choose a few familiar countries and discuss the importance of both their vertical and horizontal location. Students quickly recognize the positive correlation between income per person and life expectancy. It is a simple extension to postulate that the apparent relationship between life expectancy and income per person could be modeled with a simple line. This illustration could be used to introduce other models such as supply and demand and to inform what their underlying data might look like.

After identifying the positive relationship between per capita income and life expectancy, we initiate a discussion regarding the differences between correlation and causation. Does economic growth improve health outcomes or does improved health facilitate economic growth, or is some other factor responsible for improvements in both? This discussion also easily transitions into what potential factors may be, in part, responsible for outliers and deviations from the trend.

APPLICATION 2: POPULATION VS. GDP VS. GDP PER CAPITA

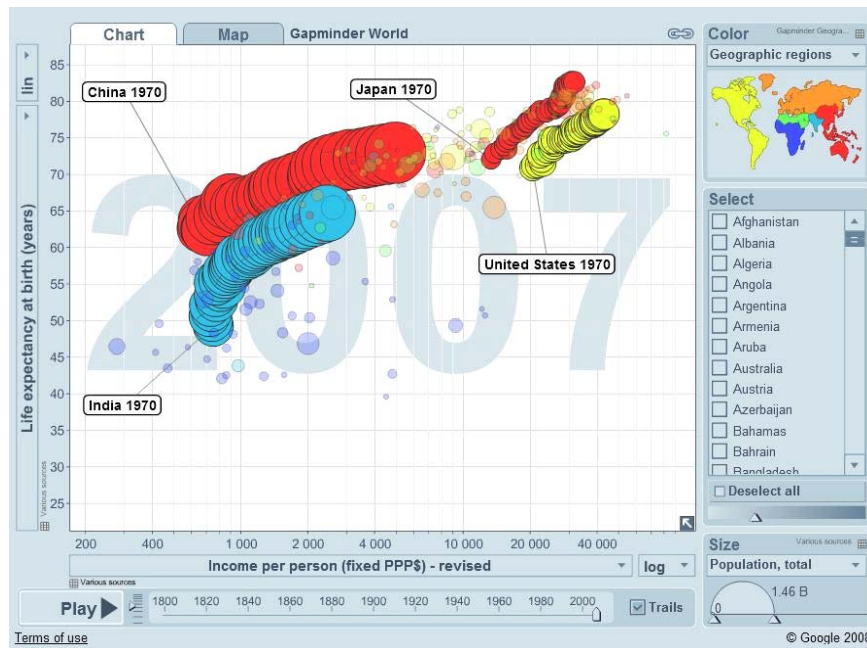
This tool also provides a fresh way of displaying the vast differences between the relevance of nations in terms of population, GDP and GDP per capita. Setting the x-axis to time and the y-axis to the log of total income (this is an option under “Economy” in the drag down menu) will provide a visual aid which can be used to contrast countries’ populations with their GDPs. We have found this discussion to be surprisingly eye-opening for our students.

Yet another contrast can be highlighted by altering the x-axis so that it indicates the log of income per person. Students are often surprised by the large number of countries with relatively small output but higher levels of income per person. The importance of GDP per capita can be underscored by asking students if they would rather live in a country with a high GDP or one with a high GDP per person. Contrasting total income and income per person for China is a nice example to highlight the importance of this difference.

APPLICATION 3: GDP AND QUALITY OF LIFE

After students have a basic understanding of GDP and how it is measured, students are typically unable to expound on the importance of GDP per capita to individuals or to their own situations. We begin with a class inquiry regarding this topic. While students are mulling over the topic, we engage them in a discussion which relates personal outcomes such as life expectancy and infant mortality rates to GDP per capita. At the heart of this conversation is the powerful visual presentation of key global economic indicators that Gapminder World makes possible.

Figure 2: Time paths for several indicated nations



Once again, we begin with the motion chart in the default setting. After a quick introduction explaining the chart, students are able to notice the positive correlation between GDP per capita and life expectancy. Changes in countries positions and in this relationship over time can then be illustrated using Gapminder World's motion chart function. Repeated plays may be necessary for students to absorb what they are seeing. Selecting a few key nations such as China, India, Japan

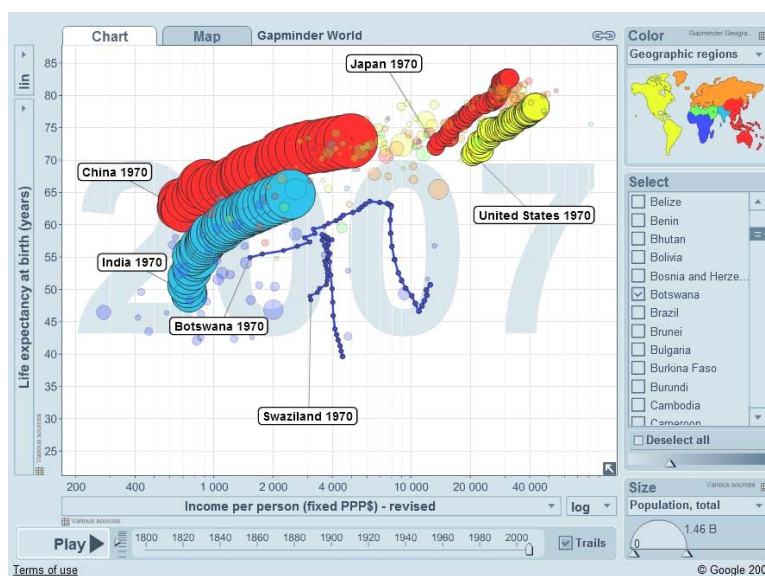
and the U.S. makes it easier to follow the changes. For an illustration see Figure 2. Comparing and contrasting the 1970 and 2007 life expectancies of the key nations highlights each nation's improvements. While the log of income per capita is being displayed, a popup box will indicate the actual income per capita. The popup box is revealed by holding the cursor over the coordinate of interest. At this point students have witnessed the link between GDP per capita and the age that they or their parents are likely to reach.

Changing the y-axis to "infant mortality rate" and repeating the process mentioned above allows an equally thought-provoking discussion on the relationship between infant mortality rates and income per capita.

APPLICATION 4: GDP VS. QUALITY OF LIFE

This tool is also very useful for discussing the shortfalls of GDP per capita as a measure of quality of life. We begin the illustration of this point again at the default setting. We then select several African nations, for example, Botswana, South Africa, Swaziland, and Zimbabwe which clearly weaken the apparent relationship between GDP per capita and life expectancy.

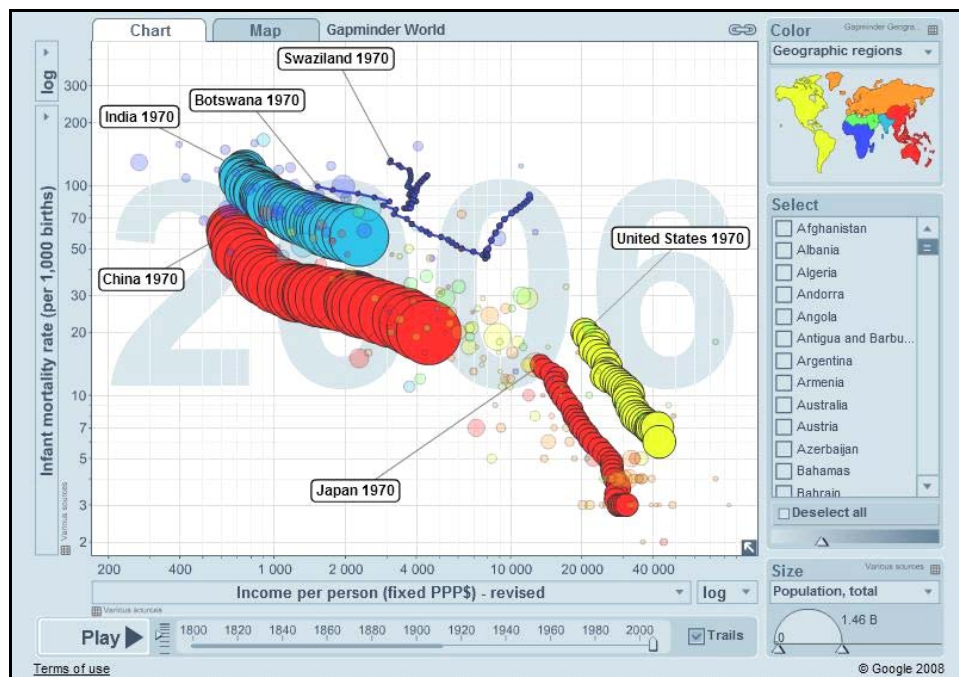
Figure 3: Devastating reductions in life expectancy as revealed in the time paths of Botswana and Swaziland



Tracking the changes in these nations since 1970 is guaranteed to shock most students as they will witness devastating reductions in life expectancy beginning in the early 90s as illustrated in Figure 3. We generally allow time and freedom for both student reflection and comments. The discussion often focuses on the cases of these reductions. The usual suspects are the AIDS epidemic, conflict and famine. All of which represent shortfalls of the ability of GDP per capita to capture quality of life. An inquiry regarding the actual underlying cause makes a rewarding student project.

Changing the Y-axis to indicate infant mortality rate in the same African countries and repeating the above process equally shocks students in our classes as it tells a similar story of hardship (Figure 4). If time allows we usually let students choose a few countries and watch their progress through time.

Figure 4: Devastating increases in infant mortality rates as revealed in the time paths of Botswana and Swaziland



STUDENT RESPONSE - OBSERVATIONS

A key obstacle, when teaching principle level economics classes, is a general apathy toward the subject matter. GDP per capita is often looked at by students as a meaningless number or an abstract construct that must be memorized for an exam. For example, economists instantly identify with the powerful emotion in the following quote from Nobel Laureate Economist Robert Lucas:

“Is there some action a government of India could take that would lead the Indian economy to grow like Indonesia’s or Egypt’s? If so, what, exactly? If not, what is it about the ‘nature of India’ that makes it so? The consequences for human welfare involved in questions like these are simply staggering: Once one starts to think about them, it is hard to think about anything else.”

Students are often unequipped to identify with the speaker. The issue here is that economists have been informed of the link between economic growth and real-life individual outcomes through an understanding of economic principles and exposure to macroeconomic data. Bridging this conceptual gap is the key to capturing student’s interest and awakening their natural curiosity. Integrating Gapminder World into the presentation of GDP can empower students from all colleges to see GDP per capita through the eyes of an economist.

We have had success overcoming this hurdle by integrating a combination of the above applications into our principles of macroeconomics courses just after introducing the concept of GDP per capita. Spending around twenty minutes of class time on these examples will create a lasting impression. A brief classroom examination of Gapminder World will empower students to take hold of this passion for the economic problem and the class content surrounding it. We have found that, after presenting Gapminder World, students are better prepared to identify with the above quote.

We have also witnessed a great deal of student interest and participation during the presentations. We refer back to Gapminder World and “the moving dots” throughout the semester. The students have been eager to discuss the possible reasons for the changes in nation’s positions and the real world consequences that go along with them.

STUDENT RESPONSE - DATA

To test student perception of Gapminder World one of the authors administered a short class survey. This survey was intended to gauge the value of the application of Gapminder World in the classroom. The survey also addresses shortfalls associated with the use of end-of-term student evaluations to assess teaching. For example, the relative lack of questions that ask about the use of new technology in the classroom (Becker and Watts, 1999). Also, concerning end-of-term student evaluations, "Little attention is given to students' perception of what they believed they learned" (Becker, 2000). The survey asked questions about the impact of the presentation (for a sample of the questions, see Table 1). Several statements were presented and students had the following options to choose from: strongly agree, agree, no opinion, disagree, and strongly disagree. These responses were rescaled from 2 (strongly agree) to -2 (strongly disagree), no opinion being the middle ground with a value of 0.

Table 1: Survey questions
I enjoyed the presentation.
The presentation was related to the course material.
The presentation was a good use of class time.
The presentation caused me to think about things that I usually do not think about.
The presentation caused me to be more interested in economics and economic issues.
The presentation increased my interest in taking more economics courses.
I found the course content to be more interesting as a result of the presentation.
I found the course content to be more relevant to my life as a result of the presentation.
I recommend that the presentation be used in the future.
I think that the presentation could be improved.

Table 2 presents simple means, standard deviations along with Z-scores used in hypothesis testing. In all but one case the average student response was positive and statistically different than zero. The exception is the response to the

question about an increased interest in taking more economics classes where the average is neither positive nor significant. This result may be negatively biased due to the timing of the survey. The survey was administered immediately after the cumulative final exam (separately and anonymously); as a result any increase in interest may have been outweighed by that “I will never take another economics class again” feeling. Also, it is worth mentioning that 32.4% of the students surveyed agreed and 11.8% strongly agreed that the presentation had increased their interest in taking more economics classes.

Students reported having enjoyed the presentation and that they were spurred to think about issues that they do not regularly think about. Perhaps the most important results are those that point toward improved student attitudes toward economics. The results for both the question related to interest in economic issues and the question related to interest in course content were statistically positive. In fact, these results may have been driven by the self-reported increase in content relevance to their personal lives.

Table 2: Results of the survey			
Survey questions	Mean	Std.Dev.	Z-score
I enjoyed the presentation	1.294	0.871	8.659
The presentation was related to the course material	1.706	0.524	18.985
The presentation was a good use of class time	1.588	0.609	15.209
Think about things that I usually do not think about	1.029	0.969	6.196
More interested in economics and economic issues	0.765	1.130	3.947
Increased my interest in taking more economics courses	-0.029	1.218	-0.141
I found the course content to be more interesting	0.647	1.098	3.437
I found the course content to be more relevant to my life	0.500	0.992	2.938
I recommend that the presentation be used in the future	1.441	0.705	11.927
I think that the presentation could be improved	-0.265	0.790	-1.953

Interestingly, students responded more intensely to the appropriateness and efficiency of the presentation than to their enjoyment of the presentation. Students also overwhelmingly supported the continued use of this presentation in the class.

In addition to the above questions, students were also asked questions related to the way that the presentation affected their lives outside of the classroom. We found that 58.8% of the students said that they had accessed Gapminder World outside of the classroom at least once. We also found that, based on student reports, 50% had brought up Gapminder World or its content during a conversation outside of the classroom, and 29.4% had mentioned the Gapminder World website or its content during conversations with their parents. We view these results as suggestive of a success in awakening student interest and we wish that all of our discussions could have this level of impact.

STUDENT RESPONSE - COMMENTS

We have selected the following responses to the survey item “Please take the time to write any comments that you have in regard to the use of this website and its content in the classroom”. The responses have been altered only to correct format and simple errors in spelling or grammar. Student comments were anonymous. All respondents are assumed to be female for convenience.

- 1 “I thought the presentation was amazing. It really opened my eyes to things I had not previously had any interest in...”
- 2 “The website was really interesting in regard to the fact that it was very thought provoking and made you think about the world wide implications of the economy. It also proved the point very well that the economy is an indicator and a part of living conditions along with other social aspects of life. I think it would be interesting to use it more in the class in connection with other lessons since it gives the material learned substance and tangible evidence.”
- 3 “It should be used early in the class maybe the first week to show how this class overall relates to solving global problems and how it is relevant to all 6.5 billion of us

whether we realize it or not. It shows how you have a vested interest in the class/study.”

4 “This presentation I found to be very eye-opening. I know I had never thought about the other countries and how their lives are compared to ours here in the U.S.”

5 “Not bad, I would use it if I taught an economics class.”

Comment 1 supports our classroom observations that this tool is helping students reach the point where they can become interested in economic issues. Comment 2 also uses the word interesting. Out of fifteen comments a form of the word “interest” appears in six. Using the above applications of Gapminder World also helped student 2 to comprehend that much of the material in the course is interrelated. Comment 3 also reveals the overarching relevance of our utilization of Gapminder World in this principles of macroeconomics course and to students’ lives in general.

We believe that it is much easier for students to learn about GDP once they care about its implications. These comments provide evidence that this tool can be used to generate interest and to provide a vivid illustration of complex concepts. It is rewarding to see that students are widening their horizons as a result of a fifteen to twenty minute presentation.

It is often difficult for students to see that our relative wealth in the U.S. alters our views on many issues. The student that provided comment 4 has learned that her perspective shapes the way that she sees the world. It is also interesting that this student chose to use the words “eye-opening”. For visual learners a reference picture can carry a lot of weight when it comes time for recollection or comprehension of abstract concepts. Out of fifteen comments three contained signals of visual learning.

Comment 5 really gets to the main purposes of this paper; which are to inform other college level instructors that this tool exists and of the benefits that it affords. This comment suggests that students recognize and appreciate efforts toward making the material relevant and interesting.

CONCLUSION

One concern of introducing novel techniques in the classroom is the fixed cost (the additional preparation time required from the instructor). Gapminder World

is a tool which has a minimal cost of utilization and great potential reward. Gapminder World's presentation of the data leaves a lasting impression that can be utilized throughout the semester. Our results suggest that many students will share and discuss the website with their family and friends and that this tool increases student interest in economic issues and principles course content. Our results also suggest that students value the appropriateness and efficiency of this teaching tool. Finally the results suggest that students enjoy the presentation and are stretched by the implications of its content.

Gapminder World contains a host of data with teaching applications for both microeconomic and macroeconomic subject matter. The applications detailed here only scratch the surface of what is available for today's economics professor. Upper level economics classes, such as health economics, public economics, economic growth and development, environmental economics as well as statistics classes (to discuss correlation) could all benefit from simple applications of this free tool. Furthermore, the simple examples mentioned in this paper could be utilized in economics classes at the high school level.

We also present some statistical evidence that presentations using Gapminder generate student interest. The results presented here have some weaknesses though and should be interpreted carefully. One serious weakness is that we only collected responses from a single Principles of Macroeconomics class, which resulted in only 34 responses. Still, the sample was large enough to establish statistical significance in most of the hypotheses.

In closing, this paper's goal is to inform our peers of the potential for student inspiration that this free website contains. It is also our hope that readers will both explore what Gapminder World can add to their courses and continue to spread the word about this innovative presentation tool.

AUTHORS' NOTE

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