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Taking the fear out of international statistics: *Gapminder* and student autonomy in a research-based English language environment

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Background

Widespread agreement on the importance of interaction in the process of language learning, together with technological developments have led to increasing emphasis on the benefits of communicating and collaborating with others online to perform tasks, share information and create knowledge. Sharing ideas or information through a range of online tools is becoming imperative in modern-day language teaching; however this also requires familiarity with and confidence in using these tools. For example:

- Connecting – exploring the use of online networks that allow students to share and interact more easily
- Collaborating – incorporating the use of interactive documents for sharing feedback, such as "Word Press"
- Communicating – using various presentation tools such as "Powerpoint" or "Prezi".

Moreover, the ready availability of internet sources means that language teachers in many parts of the world, Japan included, are increasingly engaging learners in research-based, content-based learning, drawing on authentic materials, in the fields of, for example, social, political or international affairs, in order to generate language "organically" as opposed to textbook-based learning. Student-directed learning, based on real-world information and sources, and gathered through research-based activities, not only aids language development,

but also boosts student motivation and confidence. If we also take into account the transferable online and evaluation skills which are acquired, the intrinsic benefits for the student are impressive; however, this mode of learning means that teachers have to be familiar with many online tools and resources, as well as the operating systems and software(s) to access them. An area that can cause problems for students engaging in research-based activities is the need to deal with statistics. After examining the justification for research-based activities in language learning, and the possible benefits and challenges, this article will explain how teachers may use a specific tool (*Gapminder*) to help students work with "real" statistics, share and discuss their results.

Justifications for an autonomous, research-based approach to language learning

Why is an autonomous, research-based approach to language learning required? Why is evidence, and particularly statistical evidence, so important for language learners? Why is a tool like *Gapminder* so useful? Some may question why an alternative to traditional approaches is necessary. Why is it not sufficient to simply lecture, draw upon textbooks, or rely on reading lists? Why might the "teacher as expert" model need to be re-appraised? English language learning is now being undertaken in a period of unprecedented technological advancement, both in the quality of instruments on offer and in the extent of their dissemination. Now, with an internet connection, it is possible to discover precisely how many people lived in

China in 1900 compared to 1960, or what the US economy looked like before the Wall Street crash, or what the military expenditure of a particular country was in the run-up to WWII. It is possible to practise the International Phonetic Alphabet without the need for a native speaker, possible to talk into a computer and for it to evaluate your pronunciation and, most importantly, it is possible to talk face-to-face with people anywhere around the globe. The potential to learn English, and other languages, has never been greater.

However, the nature of English teaching has also changed. An increasingly multi-national student profile coupled with the growth of teaching English as a foreign language (EFL) as opposed to teaching English as a second language in the teacher's own country (ESOL), mean that the position of the English teacher is being ever more challenged. The old "teacher as expert" paradigm is being brought into question as improvements in technology facilitate more varied learning paths, meaning that the teacher is becoming less and less the imparter of sacred wisdoms, and more and more the facilitator of self-directed, student-centred learning. This is why a more autonomous, research-based approach is so important. Students are encouraged, using the many tools known to the educator, to learn in their own way and to learn using authentic information. This does not mean that the teacher simply does nothing; in fact, it is quite the opposite. The teacher must instead be aware of a greater array of information and be able to apply a more extensive set of skills. In this author's view *Gapminder* is an essential "must know" for this sort of teacher. It is a one-stop shop for factual, statistical information. It is easy to use, easy to interpret and allows the teacher to bring high-level research into the language classroom with little trouble and with significant results.

The importance of statistics for all language students

In learning English, the language learner is not simply absorbing rules of grammar and lists of vocabulary, but also reaching towards an alternative culture. In the case of English, this culture is not homogeneously defined, and may refer to any of the "core" cultures (United States, United Kingdom, Canada, Australia, S. Africa and New Zealand) but also the many "periphery" cultures that use English as a second or even first language (such as India, Nigeria or the Philippines). Thus, English language learners

are, automatically and simultaneously, international explorers. Within this realm, it is all too easy to be overwhelmed by opinion, interpretation and subjectivity. It is important for the international explorer to base their opinions about the "other" on fact. Non-evidence-based opinions can have deleterious effects on discussion, the key arena for the language learner. One student may agree with one thing, another agrees with another thing, and the discussion may stall there. In addition, in cultures that prefer consensus as opposed to conflict, such as Japan, students tend not to want to offend others by openly disagreeing. At the university level, this is even more pronounced with first or second year students, who have possibly moved far from home and do not know any of their peers very well. An evidence-based approach to English language learning creates a sphere of commonality, where facts can be commonly understood, and the potential for fractious disagreement reduced.

Furthermore, statistics might have the potential to move students away from the position, of either being unsure and/or being too polite, that can prevent discussion, towards having the confidence to base their expressions on verifiable, "out there" information. Interactive statistical databases like *Gapminder* can take the fear out of statistics and, with careful scaffolding by the teacher, allow students to quickly understand international issues and reach a level of analysis that goes far beyond what the students themselves think is possible. In addition, the benefit of relying on statistics as a resource base is that numbers are universal whereas words are not. Of course, the interpretation of figures is language dependent, but as a starting point statistics can form a bridge of mutual understanding from which to easily scaffold. This universality can help build confidence in the development of statistical interpretation, the language required to do such interpretation and explain it to others, and the confidence to do more if needed. Students can quickly, regardless of their level, get to grips with an issue and begin to generate their own questions and research strategies.

Two serious problems that arise are that, firstly, students are often intimidated by the level of detail and amount of statistics that are involved in internationally-oriented research. Indeed, lower level students may feel unable to approach what are perceived to be "difficult" and "high level" topics. This article will hopefully

demonstrate *how these concerns can be countered*. With just a little pre-teaching and preparation, learners with a wide range of language abilities can draw on statistical resources, using tools such as *Gapminder*. These are simple to use. Both children and adult learners can benefit from the simplicity of the tools that, nevertheless, do not sacrifice on rigour. Secondly, for teachers, and older teachers especially, there can be an equal degree of intimidation (to that experienced by their learners) not only due to unfamiliarity with the technologies available but also due to their reluctance to give up a 'superior knowledge' position *vis-à-vis* their students. Educators accustomed to "teacher-led" instruction may feel uneasy about "letting go of the reins", and giving their students the freedom to take the initiative with their learning, which, at times, may involve allowing them to make mistakes.

The aim of this article is to demonstrate how, using online statistics databases, such as *Gapminder*, these worries can quickly be alleviated. It will firstly outline a simple step-by-step guide that teachers can use for the incorporation of an online statistics tool into their research-based language classroom. Secondly, it will demonstrate how fruitful the use of statistics, and, more broadly, an evidence-based, research-driven learning approach can be.

Tool Choice: *Gapminder*
Given the freedom to conduct personal research, most people, not just learners, will simply "ask Google". Due potentially to unfamiliarity with the topic, lower language abilities, or simply laziness, students will often recycle the same 3 – 5 "top" Google searches they hit. The result is that instead of developing critical learning skills such as assessing and selecting data from various sources, students will not even have their assumptions challenged. Google simply returns what is suitable based on the key words entered – it is an echo chamber for pre-existing knowledge and assumptions. *Gapminder*, because of its ease of use, coupled with an extensive statistical database, can counter this tendency.

What is *Gapminder*?
Gapminder (www.gapminder.org) is an interactive graph, powered by the statistical database of the United Nations. It is the

brainchild of Prof. Hans Rosling (left) from the Karolinska Institute, Sweden. The site is a product of the *Gapminder* Foundation, a non-profit organization that was bought by Google in 2007. The name is an explicit reference to the London underground announcements when a train approaches a station where there is a gap between the train and the platform; however, the implicit meaning refers to the gap between what people think they know and what is actually the case. Having developed the technology of the "trend analyzer", and benefitting from open access to the United Nation's databases, *Gapminder*'s example has spread to many other international agencies including the World Bank and the International Monetary Fund (IMF), who have created their own animated bubble graphs. The IMF and the Organization for Economic Cooperation and Development (OECD) have been a little slow in the release of all the various financial indicators they collect. This has led to a bias towards international development statistics as opposed to financial and broader economic statistics, thus limiting the potential for students who may be interested in business or finance, for example. However, this will surely change in the future, as transparency becomes ever more the watchword of international institutions.

Prof. Hans Rosling

A Method of Introduction into the ESL Classroom
Gapminder is a very powerful tool. First-time users are likely to feel a "wow" effect upon first use; however, this novelty may soon wear off and a possible danger is that students do not engage fully after the sparkle begins to fade.

A second potential difficulty, as with any kind of statistics, is the likelihood that it appears boring, intimidating, or both. *Gapminder* is visually simple, and deceptively easy to use; however therein lies a complexity of interpretation and logical processing and challenging cross-discipline, comparative potential, and more fundamentally for second language learners, difficult or unfamiliar vocabulary that may intimidate some of the less "numbers-friendly" or lower language level students.

Bearing this in mind, this article suggests a possible method of introduction to Gapminder in an English language learning setting. If done well, and understood clearly by the students, this need not be repeated. So it is important to take the time to set it up well. After that, the investment will pay for itself.
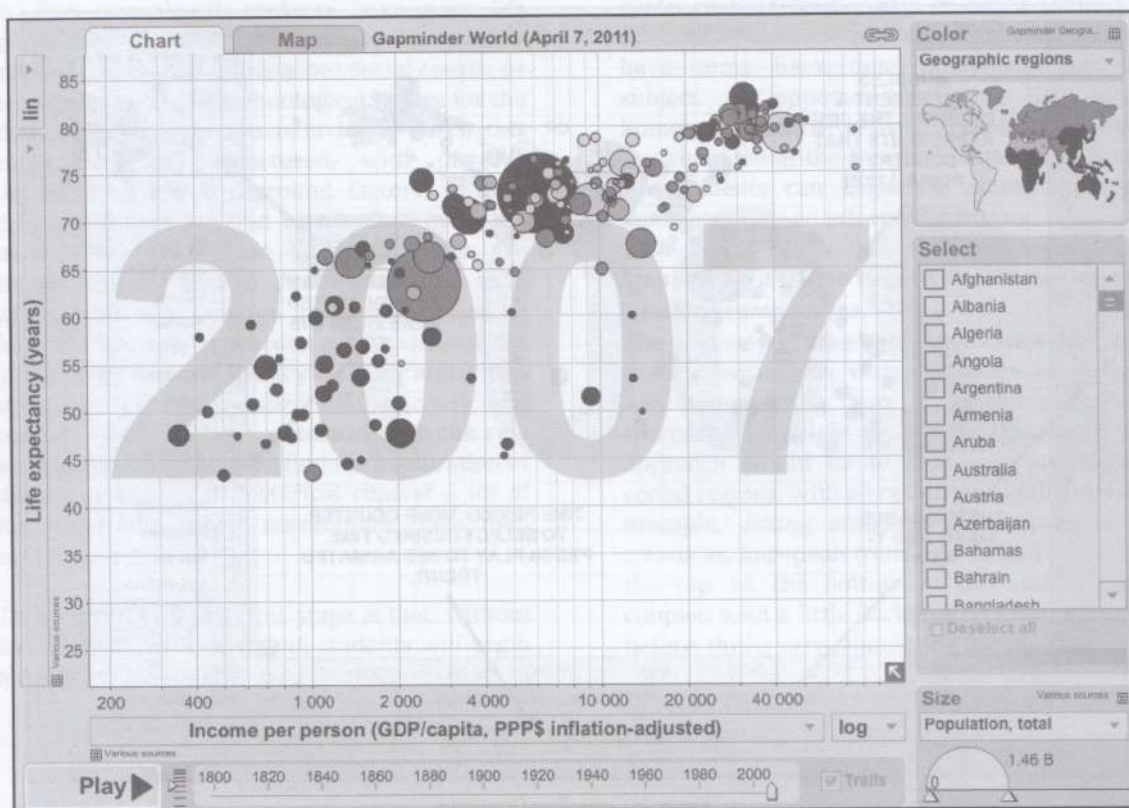

Figure 1: Screenshot of Gapminder

Step 1: Do not use *Gapminder*, at least not yet.

The best first step is to choose one particular subject area, and pre-teach related vocabulary and concepts. *Gapminder* organises data into themes, then categories, then factors, for example: health > material health > contraceptive use. It would be useful for the teacher to consult *Gapminder*, scroll down the list of all the vocabulary for category names and spend a first, vocabulary-oriented class pre-teaching both the word and the concept. It is particularly at the conceptual level that teachers will have to prepare well. Vocabulary such as (to continue the health theme) "vaccination" will be relatively easy since it is a concrete discrete noun, and lends itself even to visual cuing; however "life expectancy" is more conceptual, being a method of calculation, which would need explanation or even practice, in the form of basic math exercises.

Step 2: Now use *Gapminder,* but only a little.

The teacher's first step will be to explain the controls – what the bubbles mean, what the colours represent, and where the menu bars are. Then, the teacher can start slowly, with a basic "what" question, i.e., to simply select one factor and examine how it has changed over time. By changing the x-axis variable to "time", students can rewind two hundred years and observe changes and trends. This is best performed twice, firstly, by observing all countries for a pattern, and secondly, by highlighting the student's native country. Students will observe their country standing out against the other faded bubbles. The teacher can ask students to hold the mouse over specific points on the trend line, and pinpoint specific data which will show up on the x or y axis. This will generate a lot of energy from the students, and first reactions are often amazement and wonder. At this point, it would be useful for the teacher to step back

from the software and encourage students to generate explanations for the changes they have observed. This is best done if the teacher has some pre-prepared factual information, such as a historical event or a major invention, that can guide students towards drawing on their own background knowledge.
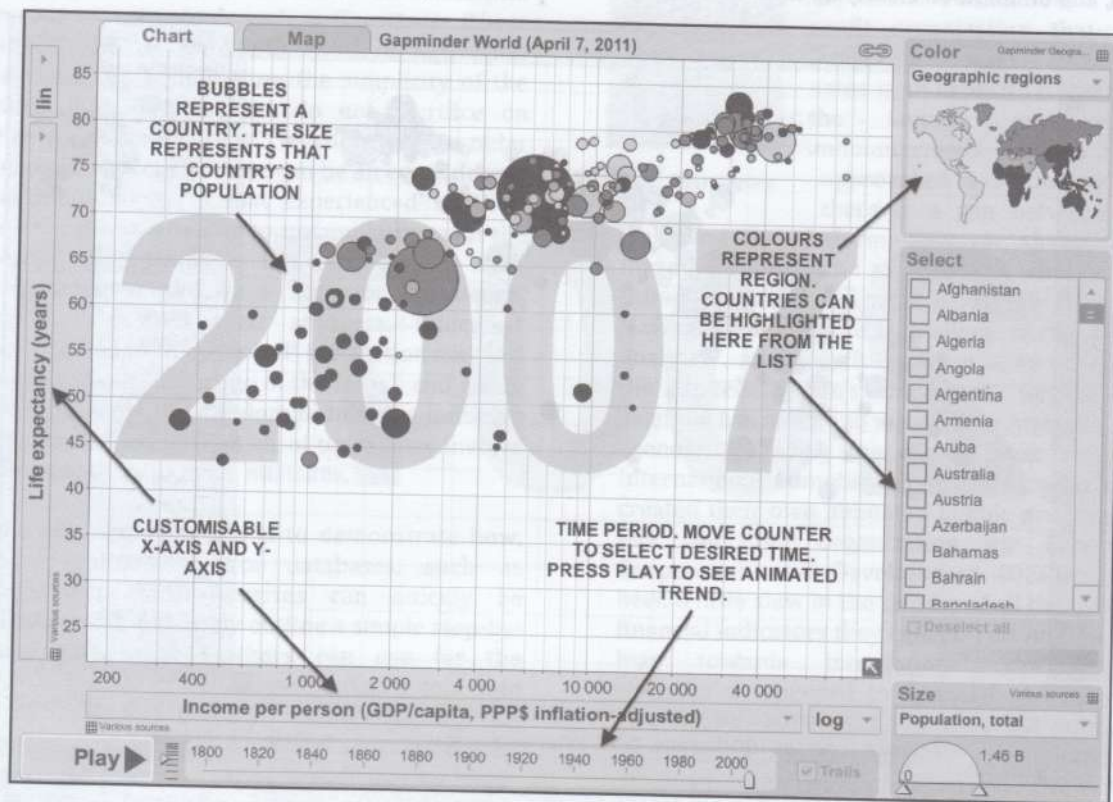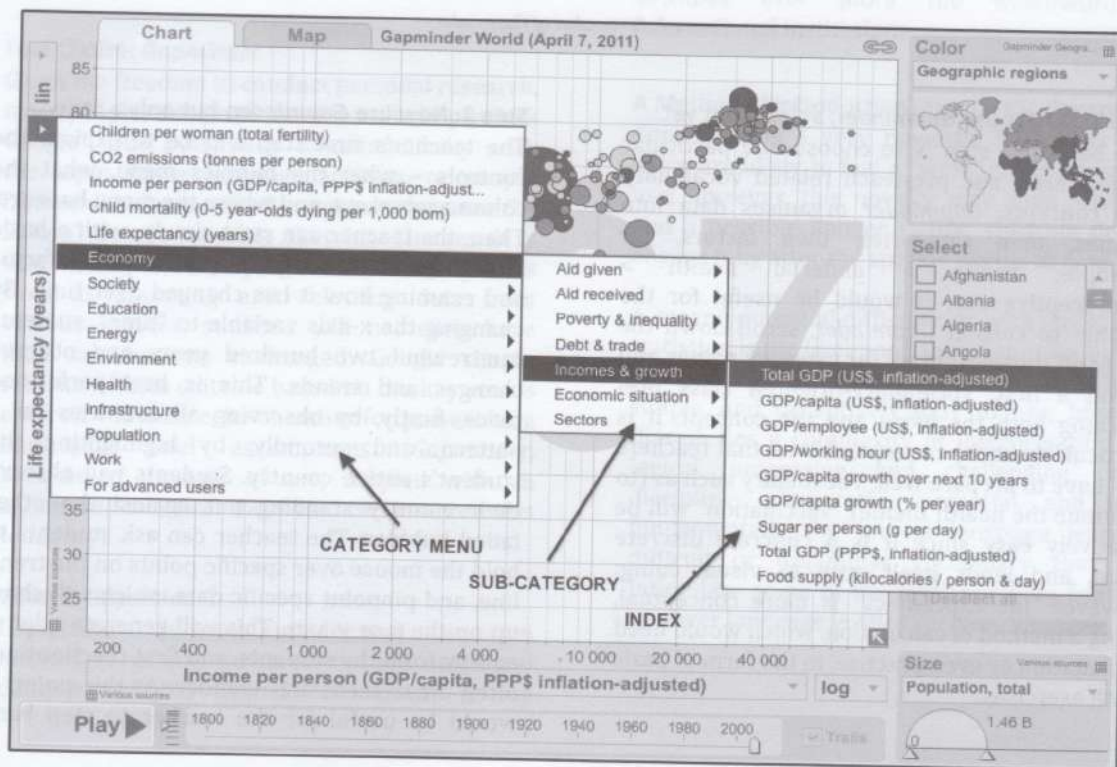

Figure 2: *Controlling* Gapminder

Figure 3: Gapminder's *menus and statistics*

Step 3: Background, background, background.
At this point, or in another class, a variety of cross-disciplinary speculations may be brought in. For example, if students have seen life expectancy increase or decrease, the teacher may ask students to think about social causes, or economic causes, or technological causes for the change. If students are of a lower level, this could be more structured, with pictures representing key background factors, so that they could then try and match them with the trends they observe on *Gapminder*. This can easily then become a first homework task, where students may go away and research further what was happening at particular dates in the case's history. The key teaching aim at this stage is to "take the numbers off the screen" and connect what has been observed with the real world. Students will often find the exploration of the factor chosen in historical context a lot of fun, especially when researching their own country.

The great point about this stage is that, without any explicit encouragement, students will begin quite spontaneously to generate their own questions, which could be used later for further research. This starting point – having a strong evidence base from which to begin their own research – means that students very quickly have some background knowledge on the subject. As opposed to having little prior knowledge on a research topic and open searching using the top three hits from Google, the students can begin by asking the right questions from an informed position.

Step 4: Now it is time to get a little more rigorous – making comparisons.
The next step to take might be to ask students to make comparisons, with a little pre-teaching of why comparisons (two, three and multi-level comparisons) might be useful. One suggested approach would be to first compare colour-coded regions, with all countries highlighted, for example, asking students to compare Asian trends vs. European trends, or to find regions at the top vs. the bottom of the scales. When coupled with a little background information as before, this is very stimulating for students.

In order to focus, the next step would then be to use the menu bar of listed countries and to
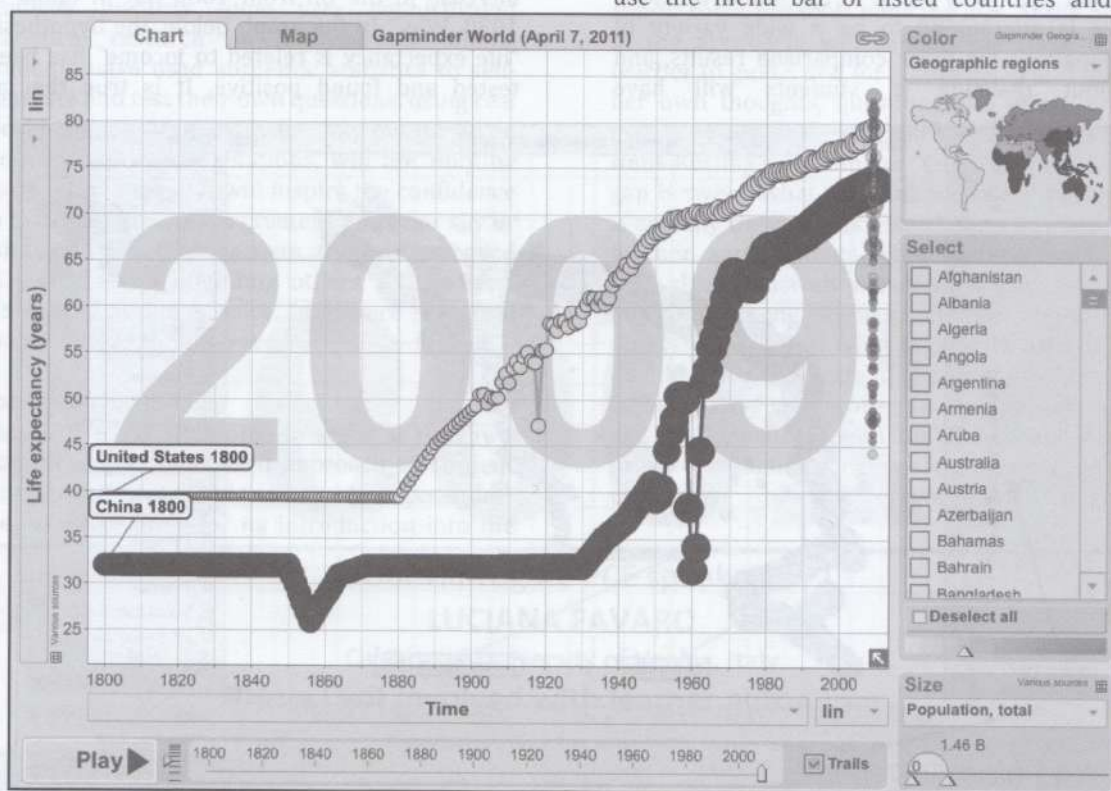

Figure 4: A comparison of life expectancy in the US and China between 1800 and the present

highlight two or three countries for comparison. A discussion on this choice is a good chance for students to justify their comparison choices in light of some prior perceptions or assumptions they may have. Once selected, and the "play" button pressed, the dots (countries) will leave trails behind them so that trends can be observed more clearly. At this or any of the previous points, it may be useful to provide students with language that can help them explain the trends/comparisons/relations they are observing, e.g., "as x factor increases, y factor decreases".

Particularly dramatic points in the trend line can be focused on and background explanation given/questions generated. Expanding on this, students may then attempt to highlight and compare countries of a particular region (as opposed to the earlier overall view). This usually raises considerable interest as well, as they discover their native country's position on a particular factor, in relation to their neighbours'. This comparison-based step is, again, conducive to the "taking the numbers off the screen idea", and students can discuss and then research why particular countries may have pulled ahead, fallen behind, or run in tandem with each other. In the follow-up class, there is guaranteed to be a wide variety of explanations for these comparison results, and without realising it, students will have

spontaneously begun generating further research questions.

Step 5: Asking the "why" questions.
Up until this point, *Gapminder* has been used to simply "look" at the data, to ask descriptive questions about "what is happening" or "when something happened". Students have been generating their own questions and attempting to explain them with background research; however, *Gapminder* could then be used for something really exciting, i.e., hypotheses testing. Without any complicated explanations of theory, the scientific method, or any such "scary" research talk, the teacher can encourage the students to ask questions based on the data of one factor, and attempt to correlate with other factors that might help to answer their question. By manipulating both the x and y axes (until now the teacher may have only been looking at one factor on the y-axis with "time" on the x-axis), the teacher can ask students to keep the y-axis stable (the dependent variable in research jargon), but then repeatedly change the x-axis (independent variable) and attempt to spot any correlations that might occur. For example, in the figures included above and below, we can see life expectancy beginning to increase in the US from 1880 but in China in 1930. Why? In the graph below, the hypothesis "life expectancy is related to income" has been tested and found positive. It is true that as
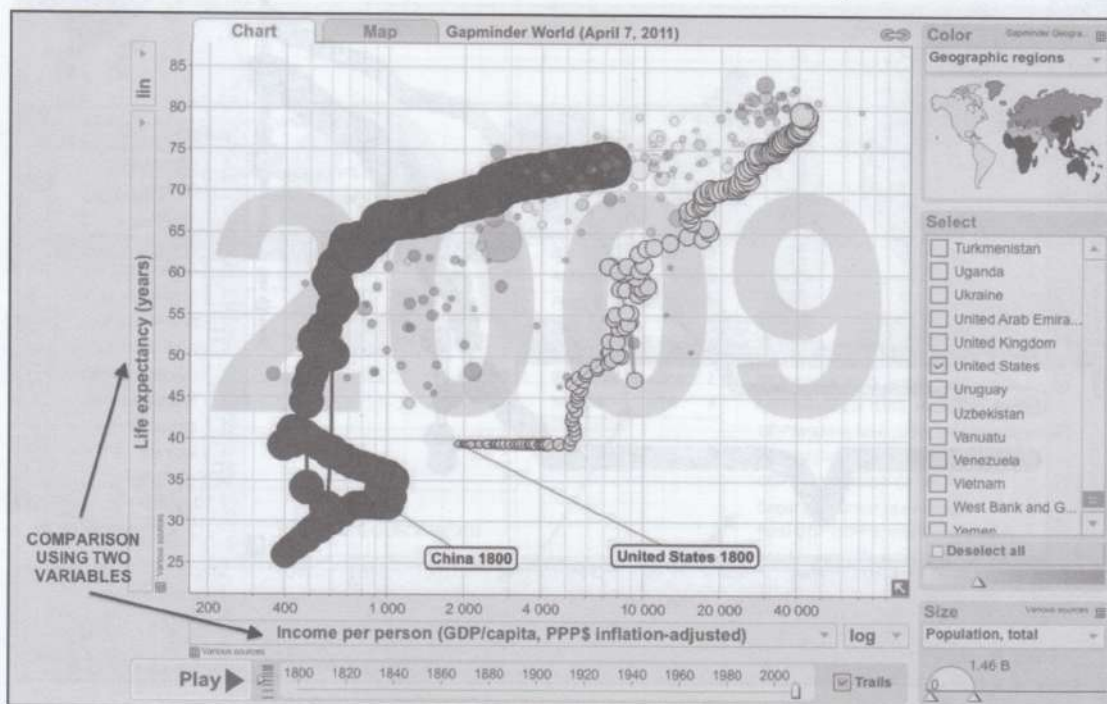

Figure 5: A multi-variable comparison

individual income increases, so does their life expectancy. However as can be seen in Figure 5 the relationship is not even or smooth. There are clearly other factors involved and so students can be encouraged to switch around the independent variable and attempt to find other relationships with the dependent variable (health expectancy). This is great fun, and can generate extended periods using *Gapminder*.

Homework and "getting the numbers off the page" again could possibly mean asking students to speculate on qualitative explanations of the relationships they have discerned. An extra level of complexity could then be to highlight all of the countries from the comparison task in the previous step, and combine the comparisons with each of the differing x – y axis variables. This would lead to a between-case and across-variables comparison, which could become complicated. Encouraging students to create a grid for recording the results of these multi-layered correlations (see Figure 6), in addition to dividing the testing of different variables between group members, would be helpful in encouraging both the systematic nature of inquiry and the collaborative nature of research.

Life expectancy and….			
	Income	Education Level	Health spending
US			
UK			
Japan			
China			

Figure. 6: Example recording frame for students' research process. Record results with ticks or crosses, or scales for strong/weak

In summary, without any complicated jargon like "independent variables", "correlations", or "causation", or any deep discussions on the nature of research or the scientific method, *Gapminder* has enabled the teacher to guide students towards some very sophisticated statistical research on international affairs. Students have used authentic statistics to self-generate and test their own questions, using real world primary level evidence. Any output work, from essays to presentations, will not only be more interesting, but will inspire the confidence to discuss more, and in greater depth. For shy or otherwise reluctant learners, there is less need to worry about offending others, as the facts discovered are, in essence, "out there", external to the speaker for all to see.

Conclusion
This article has attempted to argue as to why a statistical, research-based approach to student autonomy is useful and to this end, a potential step-by-step guide for its introduction into the English language classroom using *Gapminder* was outlined. In conclusion, the acknowledgement and proviso must be made that *Gapminder*, and other interactive databases like it, are just tools; powerful and deceptively simple tools, but tools none the less. At the heart of the approach, will remain the need for a teacher to guide, and for a student to add his or her own thoughts, questions and effort. From extensive personal experience, I have found that Hans Rosling's meaning of "Gap"-"minder" – the gap between what we think we know and what is actually the case – is indeed a gap to mind, for teacher and students alike. However, what I have also extensively witnessed is its ease of use and the strong impression the application makes on learners. What is initially believed to be difficult to understand is speedily uncovered as being easy to discover. In my opinion, more use of *Gapminder*, with all the advantages it brings to English language classrooms, would ultimately be to everyone's benefit.