Turning web 2.0 tools into tools for teaching statistics

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This paper aims at stressing the opportunities provided by the web 2.0 for introducing a new approach to statistics in schools and academia. Our approach is supported by two strictly connected motives: first, the web 2.0 new technology, widespread and easy to use, allows strong interactivity, facilitates and encourages a continuous evaluation of the stuff found in the web. Second, students use this technology in their everyday life for communicating, playing, listening to music, downloading movies and also studying. This paper aims at showing that Statistics education could profit from the combination of these two aspects, describing how some websites provide interactive lessons, explanations, information about data (metadata), ways of representing statistical information and so on.

INTRODUCTION

This paper deals with web 2.0 and statistics, trying to take into account the point of view of teachers and students as users, following a path from teaching the fundamentals of statistics to the dissemination of statistical information. Our reflections move from a particular perspective, as webmasters of the part of the site of Statistics Italy devoted to helping the world of education in approaching official statistics. We think that this provides us with a knowledge of what they demand as *users*. This perspective is different from that of educators and, however limited and possibly biased, throws a different light on the possible marriage between statistics and web 2.0 tools. The paper illustrates briefly the context in which these tools affect teachers and students; the environment in which they live and act; why these tools are so attractive and effective; and finally some examples related to the application of web 2.0 tools. The main conclusion is that students and teachers should not only know and consult the websites adopting web 2.0 concepts, but also use these tools *as tools* in the day-by-day process of teaching and learning.

THE WEB 2.0

The set of approaches and software constituting the web 2.0 movement is today so widespread that a proper definition is difficult but superfluous. Web 2.0 is at the same time an *environment* and a *language* encompassing many fields: communicating (instant messaging), sharing (blogs), buying and selling (online auctions), exchanging (peer-to-peer), creating multimedia content (Flash), meeting people (3D worlds), collecting (downloads), co-ordinating (wikis), evaluating (reputation systems), searching (search engines), programming (modding), socializing (chat rooms) and learning (surfing and browsing). Which features make web 2.0 so attractive and familiar? Why do they perfectly fit the behaviours and attitudes of young and adult people? Why do we tend to use them in every field of our life, extending their scope every day? The answer to these questions lies in their fundamental approach: a treasure of collective (and connective) knowledge is hidden under the online connection of millions of people, and this wealth can be made available thanks to co-operative tools. In fact, web 2.0 is not a new software tool (web 1.0 was, arguably, a new software tool, the browser, superimposed on an existing infrastructure, the internet), it is a new way of using the web. Its tools are too famous to list: Wikipedia, YouTube, the blogosphere, MySpace, Twitter, Facebook, Flickr, de.li.cious. What these tools do or make possible is also wide and ill-defined. Suffice to say that they are changing the economy; think of *the long tail* (Chris Anderson, 2007) and of the diffusion of free goods and services. More relevant to our field, they are changing quantitative information (number-crunching and mash-ups), the body of knowledge (co-operative, self-correcting encyclopaedias) and the way it is organized (folksonomies). The collective use of all these tools represents its core, its newness. Pierre Levy (1994), who coined the term "the collective intelligence", attributes to the web this particularly good feature: putting intelligence together produces its improvement. The web (the *web 1.0*) has changed our life, forever and dramatically; but today's

web is different, not only in its degree of diffusion, but also in kind. The tools listed above differ from those of the past in that they allow people not only to access and use the contents available on the web, but also to play a direct, active, leading role in producing, improving, increasing contents in every field. With blogs and YouTube, for example, everybody can generate contents – texts, images, photos, music – and upload them on the web. This is the crucial difference: the momentous shift from the user as consumer to the user as producer (pro-sumer).

KNOWLEDGE AND PARTICIPATION

Producing content is related to producing knowledge. Maybe the relation is not one-to-one, nor so direct, but is relevant for educators. Take *SciVee* as an example: it is, so to say, the YouTube of science. You can consult it, use its clips in your lessons or homework (user as consumer), but you can also easily enough produce your own *SciVee*, either from scratch or modifying and building on something you find on the site. This is a great new opportunity for education: a wonderful combination of new ideas and a technology, easy to use, that enables us to produce new contents. Together with the possibility of creating content, a central aspect is the *interactivity* these tools provide.

Another feature of the web as experienced by students is *participation*: the diffusion of weblogs is a good example. Bloggers are there to communicate; readers want to be informed (mainly, or also) by blogs. This is a self-sustaining process, which explains the growing diffusion and the growing disposition to write and read blogs.

Interactivity and *participation* is what students expect, simply because they are accustomed to it. They learnt to live with interactivity from childhood. But they don't find the same approach, the same environment in the field of education. They don't find interactive web 2.0 tools at school as learning equipment. *The Guardian* (25 march 2009) reported a draft plan of the new primary school curriculum where there is a crucial role for Twitter and Wikipedia.

THE WEB 2.0 IN THE EDUCATION

We think that they should be able to find the same tools in school and in life, for the simple reason that when they don't find them, they lose interest in the school environment. For instance, they start playing videogames before they learn to read, and these games present specific features conducive to playing with enthusiasm. The contiguity between videogame features and web 2.0 concepts facilitates the move from one environment to the other and helps us in understanding why this strategy is relevant in teaching in general and teaching statistics in particular. The skills needed for playing videogames are speed in moving and making decisions. The situation simulated in videogames implies interactivity, speed in acting, instant answer, peer-to-peer co-operation, a kind of relationship where authority (even teachers' authority) is not granted but conquered on the field through a reputation system (the same we use on online auctions), a world where anybody can comment and refuse any statement, irrespective of the source (unless the source is *reputed* a dependable one). These specific features anticipate and then overlap those of web 2.0., where users prefer graphics rather than text, value random (hypertext) over sequential access, and ask to be networked most of their time. Other dichotomies stress the differences with the traditional approach: simultaneous vs. sequential; complex vs. linear; correlation vs. causation; burst vs. extended effort; chaotic vs. systemic (the strongest objections come from teachers, because for students lifelong learning is already practiced by being always online). This is what happened in the past in the field of technology and, through technology, in everyday life. For a better understanding of this development and the situation we are living in, we can adopt two terms: "digital natives" and "digital immigrants". Let us quote the Wikipedia, one of the first and best known web 2.0 tools: "A digital native is a person who has grown up with digital technology such as computers, the Internet, mobile phones and MP3". Marc Prensky (2001) claims to have coined the term "digital native", for a generation – the 3 to 25 years old – born and grown in a digital world. The term draws an analogy with native peoples, for whom the local religion, language, and folkways are natural and indigenous, and immigrants, expected to adapt and assimilate to their new home. The author of the definition considers all people aged 25 and up, "digital immigrants".

Even if technology has changed the way we live once and for all, the changes synthesized by the web 2.0 concept impacted in different ways with respect to some specific aspects. We will now try to consider these aspects with specific reference to the field of education, namely to the teaching of statistics. What is the typical approach of digital natives? They like parallel processing and multi-tasking, have little patience for lectures, step-by-step logic, and "tell-test" instruction. Steven Johnson (2005) emphasizes another aspect. He notices that playing video games forces people to make decisions, and that this implies "weighing evidence, analyzing situations, consulting long-term goals, and then deciding". This intellectual labour is a sort of collateral learning: the activity is probing and telescoping. Furthermore videogamers know that the rules are not entirely established before starting to play, but you learn by playing; so all this confirms that the player has to probe, to hypothesize, to re-probe, to think again. The author concludes that gamers "are learning the basic procedure of the scientific method". And as concerns "multitasking", Johnson makes a distinction between this and telescoping: "multitasking is the ability to handle a chaotic stream of unrelated objectives. Telescoping is about constructing the proper hierarchy of tasks and moving through the tasks in the correct sequence. It's about perceiving relationships and determining priorities."

And we, the digital immigrants, have been infected, too. In general, this approach has replaced the previous systems in every field of our lives; we are all used to receive information really fast, instantaneously. We spend time listening to downloaded music, watching downloaded movies, buying books and everything else through Amazon or e-Bay, watching our friends' photos and uploading our own on Flickr and so on. The only difference being that we (people aged 25 and over) have learnt and adapted our habits during these 20 years, while the "digital natives" have found this world when they were born, without the need to adapt. "Digital natives" do not, cannot remember how life was before and their behaviours are ruled by digital tools. As already said, it is the strong interactivity these technological items provide that makes social networks so attractive for both "digital natives" and "immigrants".

We need to incorporate the same combination of desirable goals and interesting choices into the classroom. Teachers often claim that their students are not interested, do not pay attention during lessons. The reason should be clear by now. The lack of attention is primarily a problem of attention span: traditional, frontal lessons are just too slow, as compared to the learning happening online, be it in gaming, social-networking or just browsing. Secondly, the separation of lesson time, study time and leisure time is incomprehensible to the digital natives: they are and want to be "always connected, always on". For instance, when playing MMORPGs – massively multiplayer online role-playing games – they are socially interacting at the same time (and maybe chatting too). They are accustomed to collateral learning (Johnson, 2005). Playing videogames is addictive, but this is not necessarily bad: paying attention, acting, living, making decisions, interacting in manifold complicated situations – these are all desirable skills, which can be put to fruition in learning and education. Experts (sociologists, anthropologists, psychologists) are researching to understand whether these changes are affecting the mind of young people and their behaviour at a deep level, rather than at a shallow or thorough one. We don't have a final answer yet. But it is clear already that as a result of this environment, today's students think and process information in a different way from their predecessors. But teachers assume that learners have not changed, and that the same methods that worked in the past will work now. This assumption is no longer valid. Today's learners are *different*. Is it that digital natives *can't* pay attention, or that they *choose not to*? Often from the natives' point of view their instructors make their education *not worth* paying attention as compared to everything else they experience. Should the "digital native" students learn the old way, or should their educators develop a new strategy, learning from the world their students live in? Unfortunately, no matter how much the teachers may wish it, it is highly unlikely that "digital natives" go backwards. In the first place, it might be impossible – their brains may already be different. Today's teachers have to learn to communicate in the language and the style of their students. This *doesn't* mean changing the priorities in developing good thinking skills and in transmitting structured knowledge. But it *does* mean going faster, less step-by step, more in parallel, with more random access: adopt the environment and the language outlined above. In this framework teachers have to play a leading role in order to meet the students' expectations and to face this new situation. Of

course, it is not primarily a question of changing the contents teachers deliver (even if one may imagine that contents themselves could be affected, in the end), but of changing the way we teach, the tools we use for teaching.

THE WEB 2.0 TOOLS FOR TEACHING AND LEARNING

The web 2.0 tools we propose to use extensively in schools are already available and we are going to introduce a few examples. What they have in common is that they provide teachers and students with a twofold opportunity: they can be used in a passive way (for consulting, browsing and so on), but also in an active way (they can be implemented, re-invented, re-built in the school and university, by adding new contents and new uses).

These tools belong to national and international institutions, like the OECD, Statistical Offices, Universities, and Scientific Societies. We find a common pattern: the contemporary use of texts, videos, images, animated graphs and so on. We consider all these experiences useful and attractive for engaging students in approaching statistics.

OECD plays a leading role in promoting the creation and use of these new tools. *Wikigender* (launched on March 7, 2008) is a project initiated by the OECD Development Centre to facilitate exchanges and improve knowledge on gender-related issues around the world. This site is created on the wikipedia platform; users can get information, and – more importantly – they can interact by inserting articles, issues, data. *Wikigender* is introduced by a video, in line with the widespread use of *YouTube* in every field. OECD indicators can be consulted with *Gapminder* (created in 2005)**,** dynamic graphics that allows users, through the software *Trendalyzer*, to select the indicators and then to play with time, select countries, track and compare their performance, converting boring numbers into enjoyable, animated, interactive graphics. OECD has recently developed a new tool for consulting territorial data: *OECD Explorer*, an online data visualization tool for exploring and analyzing regional statistics. The tool compares geographical maps with several other forms of beautifully rendered visual presentation (such as scatterplots and focus maps) while using different mechanisms for selecting specific groups of regions. All these tools are interactive, can be used, re-used, commented. OECD releases its data also through *Swivel*, a site where you can download and upload your data, compare them, add and re-use them. *Many Eyes* is a site where users can explore through visualizations, participate creating visualizations, uploading data set and learn more. *Many Eyes*, as we can read in its home page, "is a bet on the power of human visual intelligence to find patterns…It is that magical moment we live for: an unwieldy, unyielding data set is transformed into an image on the screen, and suddenly the user can perceive an unexpected pattern."

ABS, the Australian Bureau of Statistics, has launched *Statistically Speaking*, a blog for librarians (and the first blog for the ABS) and other like-minded information professionals featuring the latest information, news, tips and stories relating to the Australian Bureau of Statistics. The blog delivers articles and news as soon as they are released.

Stat Project, Statistical Information, Visualizations and analytical softwares is a blog aiming at building a community for statistical analysis, where theories, software, handbooks and so on are available for comparison, data interchange, sharing problems and different points of view. The blogmaster suggests themes for discussion (Theory, Data Mining, Quality Control) and people comment the posts.

In addition to these specialized tools there exist also educational tools, instruments planned and built for re-use, that teachers can adopt and fill in with contents.

Web 2.0 Teaching tools lists websites and webtools that can be used by teachers in colleges and universities. The blogmaster invites people to send in additional tools. *Web 2.0 Teaching tools* introduces the *Classtools.net*, a set of templates, free, customisable, available for teachers to fill in the blanks and images, created by Russel Tarr, a history teacher. Some are interactive games, others are fill in the blanks. Students can save their workup to 12 months on the *Classtools.net* website. As an example, the Venn Diagram template allows teachers to fill in as much of the diagram as they want and provides instructions in a side box. Students can enter their name, then follow the directions to create their own Venn Diagram. They can then save it online or print it out and copy and save or send the URL for later access and revisions.

Classroom20.com is the social network for those interested in Web 2.0 and collaborative technologies in education. Participants are enabled to create their own teaching tools .

Steve Hargadon, a teacher expert in new technologies, is responsible of a kind of Facebook of education, called *LearnCentral*, about teaching and learning, through which teachers can be connect with colleagues, share contents, join discussion groups, attend events, collaborate with others in virtual meeting rooms.

More wiki ideas for the classroom is one of the uncountable examples of sites and blogs dedicated to teaching, for sharing, comparing the experiences.

FlowingData declares in its home page "Explores how designers, statisticians, and computer scientists are using data to understand ourselves better, mainly through data visualization. How can we understand these data flows? Data visualization lets non-experts make sense of it all".

TeacherTube is a site where it is possible to find a lot of educational videos for teaching. The functions allowed: upload, tag and share videos worldwide; support files to attach your educational activities, assessments, lesson plans, notes, and other file formats to your videos; browse hundreds of videos uploaded by community members; find, join and create video groups to connect with people who have similar interests; customize the experience by subscribing to member videos, saving favorites, and creating playlists; integrate TeacherTube videos on websites using video embeds or APIs; make videos public or private users can select to broadcast their videos publicly or share them privately with those they invite.

The *Global Education Collaborative* is a community for teachers and students interested in global education contribute by adding media, conversation, and collaborative project ideas.

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