Visualisation and social media as educational tools of national statistical offices, examples and best practices

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Introduction

Promoting statistical literacy is a strategic goal of national statistical offices, as being statistically literate is a growing requirement in our society. It is not so far back in the past when the Internet became common and statistical offices made their data publicly available for everyone. It became evident that a number of users of statistics do not have the basic skills to use and interpret statistical data, let alone share them and educate others.

Since then a lot has been done. Statistical offices have created e-learning materials, paid attention to their statistical releases as well as the user interfaces of their websites to make them more user-friendly, easy to access and understand. They have segmented their users into groups that have similar needs, roles and abilities in the understanding, using, processing and sharing data, and created products and services accordingly. (See e.g. Helenius & Mikkelä 2011.) As the society and tools are changing, new means of visualisation and social media enter the field, offering new possibilities for presenting statistical information. New platforms take statistics to where the public are and help to tell the story behind the numbers.

This paper is a collection of examples of the ways national statistical offices and international organisations use social media and visualise statistical information with the viewpoint on education and statistical literacy. The paper is not just about the newest technology. It is also about projects that have spread widely, contributed to enhancing statistical literacy and raised awareness towards statistics.

Statistical literacy promotion by e-learning resources and co-operation projects

There are various definitions for statistical literacy. To summarise some of the most cited definitions, "statistical literacy is the ability to understand, interpret and critically evaluate statistical information, data-related arguments and conclusions, and the ability to understand and be aware of the role of statistical information in our daily lives" (e.g. Wallman 1993, Gal 2002, Schield 2010). Statistical literacy is a basic skill in our ubiquitous information society where statistical information is everywhere. It is a skill necessary when reading newspapers, following news broadcasts or surfing on the Internet. It is a skill needed when trying to pick the relevant information out of the irrelevant and to question statements given as facts.

Several national statistical offices have operational strategies and action plans for promoting statistical literacy and, as an outcome, vast amounts of e-learning materials are available on the Internet already (see e.g. ISLP 2008). Not too many of these materials are interactive and many of them need development from the technological point of view. However, the production of an interactive learning environment requires both resources and expertise that national statistical offices struggling with basic statistics production often lack. This is where international co-operation projects, third party organisations and enthusiastic individuals enter the picture.

Let us start with the pioneering e-learning environment ALEA (www.alea.pt) of Statistics Portugal. The material is mainly aimed at primary and secondary schools, and the website contains several educational resources, entertainment, and downloadable material. The special attraction of the material is the possibility to use regional data for learning.

Statistics Canada's Education Outreach Program includes a number of interactive learning resources on the website (www.statcan.gc.ca/edu/index-eng.htm) that are targeted at students and teachers at different levels of education. The learning material that is based on up-to-date statistical data is complemented by a network of experts giving support via seminars and workshops. Other long-term providers of learning materials are the Australian Bureau of Statistics (ABS) with its Education services (http://www.abs.gov.au/websitedbs/cashome.nsf//Home/Entry+Page.es?opendocument#from-banner=GT) and Statistics New Zealand with its Schools Corner (http://www.stats.govt.nz/tools_and_services/services/schools_corner.aspx). These materials are similar in that they have structured lesson plans, which makes them easy to use for teachers and students at each educational level (Sanchez 2010).

A recent example is the e-Course in Statistics (www.fernuni-hagen.de/statliteracy/), published by the Maltese National Statistical Office in co-operation with the University of Hagen (Germany) and Statistics Finland. The material is primarily intended for young adults attending post-secondary and first years of tertiary education but it can be useful to anyone in need of occasional help in understanding statistics. The material is divided into sections accompanied by a media gallery section with external links to interactive graphs and tables as well as to current materials to support putting the statistical information into everyday context. (Mittag 2010.)

Statistics Lithuania is offering teachers and students a visually attractive learning environment (http://mokyklele.stat.gov.lt/index.php?id=74). The material can be credited for its animations and an approach that clearly stems from the world of children, making it interesting and easy to understand. The material is divided into sections, such as statistical calculations and conducting of a statistical survey. The material is in Lithuanian but the following picture demonstrates the idea and visual elements of the service.

A picture capture explaining sampling from the e-school of Statistics Lithuania

The International Statistical Literacy Competition, organised by the International Statistical Literacy Project (ISLP) (www.stat.auckland.ac.nz/~iase/islp/home) of the International Association of Statistical Education (IASE), is now organised for the second time. The aim of the competition, which is intended for secondary and upper secondary school students, is to improve the abilities of young people to describe their environment with the help of statistics and make use of statistical data in diverse everyday situations. In other words, to make the students statistically literate citizens and maybe even raise their interest towards statistics as a future career.

The competition is a poster competition under the theme of environment. The competing students work as teams to produce a poster by exploiting statistics. Through teamwork, the project wants to bring students

with various skills to work together and emphasise that statistics is not a synonym to mathematics. Making the posters develops the students' statistical thinking, skills to work with, interpret and present statistical data, and to investigate current real-life problems relevant to them. It is learning by doing, not just processing tasks distant from their everyday life. (See also Griffiths and Sheppard 2010).

The international competition is organised in more than 20 countries and, thus far, over 4,500 school students have been registered. The project wants to encourage students from all around the world to participate regardless of the technology and tools available. This is why posters on traditional paper as well as electronic ones are judged as equal. In addition, the used language can be the native language of the country, which is later translated into English by country co-ordinators.

Census at School (www.censusatschool.com/) is an international project that gathers data from and about school students and returns the data to them. The project aims to encourage children to get involved with data handling, statistics and statistical thinking with real data. In addition, the project aims to increase awareness of national censuses and show how Information and Communication Technology (ICT) and the Internet can be used effectively in teaching and learning.

The idea of the project is that students enter their own survey data via the Internet and then process the data together with international data from other participating countries. The questionnaire includes international as well as national questions concerning matters close to the students' everyday life, such as preferred sports and activities, future plans and number of text messages sent per day. The collected data are then used to teach statistical concepts, measurement, data analysis, and graphics, as well as to explore social concepts. Students can compare their class data with random samples from other students around the country and with random samples from the international database. The project is presently running in the UK, Ireland, South Africa, Canada, New Zealand, Australia, the United States and Japan.

Adoption of social media at national statistical institutes

The definition of social media is not yet explicitly established. When defining social media the one in the English Wikipedia is very often cited also by academics (Erkkola 2008). Social media are media for social interaction, using highly accessible and scalable communication techniques. Social media is the use of web-based and mobile technologies to turn communication into interactive dialogue. Social media can also be defined as a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, which allows the creation and exchange of user-generated content. (Wikipedia 2011.) Lietsala and Sirkkunen (2008) have distinguished genres of social media (some current examples of tools are presented in parentheses): 1. Content creation and publishing tools (blogs and wikis); 2. Content sharing sites (YouTube, Flickr); 3. Social networking sites (Facebook, LinkedIn); 4. Collaborative productions (Wikipedia); 5. Virtual worlds (second life); 6. Add-ons (Google Maps). To summarise, social media encompass aspects of technology, interaction as well as jointly created contents and meanings.

With the support of Eurostat, Statistics Finland, has investigated European national statistical offices' experiences from social media. The aim of the survey was to study experiences from the use of social media, e.g. the goals, target groups and used services as well as the opportunities, threats and risks related to the adoption process.

The survey was carried out between August and September 2010 as part of the bachelor thesis work of Anu Vesterinen (2011). The electronic questionnaire contained 31 questions, some structured and some free-form. The target groups of the survey were members of Eurostat and the Dissemination Working Group (DWG). The survey ended up getting 33 answers. Some interesting points of the results will be summarised next.

According to the survey results, 61% of the organisations had adopted social media as a tool in their external communications. The most popular tool was Twitter, applied in 35% of the organisations. Forums and wikis where used in about 20% of the organisations. YouTube, blogs, Facebook and groups where used in about 15% of the organisations. In addition, 85% of the 13 organisations that were not yet using social

media stated that they would use them in the future. Only two organisations stated that they are not going to use social media in the future. In most of the cases, social media had been adopted quite recently. The overall experiences were neutral or positive. Some respondents thought it was too early to report on experiences. Most importantly, none of the respondents considered the experience as negative.

From the viewpoint of this paper, the most interesting outcomes of the survey are the purposes for which social media are used. According to the survey, the most important purpose for an organisation's presence in social media is sharing of knowledge and information. Almost as important is promotion of the use and understanding of statistics, search for new audiences for statistics, improvement of user support and staying in touch with users. Especially students were seen as a crucial target group but, on the other hand, social media were seen as efficient means of communicating statistics to citizens and large audiences. The results support the notion that social media can be of relevance when enhancing statistical literacy and improving awareness of statistics.

Statistics Estonia is an example of a national statistical office that has adopted social media in external as well as internal communications as shown in the case example published in Vesterinen's (2011) bachelor thesis and presented by Anne Nuka at the Dissemination Working Group 2010. Statistics Estonia has Facebook and Twitter accounts for social networking and publishing. In addition to statistical releases, Facebook is used for the marketing of products and services. Statistics Estonia is also hosting a blog and using Slideshare for sharing expert publications and presentations. All these are in Estonian for the moment. Statistics Estonia has set clear goals for its adoption of social media, such as reaching of current and potential users, creation of positive publicity, changing of opinions and promotion of the use of statistics. In addition, resources have been allocated for social media. There are ten experts, including the Director General of Statistics Estonia, producing material for the blog.

Another example of successful social media usage is the World Statistics Day that was celebrated for the first time in more than 130 countries on 20 October 2010. The purpose of the day was to celebrate the many achievements of official statistics and the core values of service, integrity and professionalism. The communications campaign for the day used YouTube, Facebook and Twitter in addition to other, more conventional media, such as an international website and e-mails. According to the report of the Secretary General (2010), the Facebook account drew nearly 4,000 followers. Many users posted links to articles regarding the day or to activities to celebrate the day. In addition, many videos were created to promote knowledge about statistical work and censuses among various audiences. See, for example, "A Day in Figures" by the National Statistical Office of Spain (http://www.ine.es/en/diamundesta/diamundesta_video_en.htm) that presents international statistical information in an interesting way. Or "We are Statistics Canada" by Statistics Canada (http://www.statcan.gc.ca/about-apercu/video/statcan-eng.html) that presents in a couple minutes the essence of what Statistics Canada does and what statistics are used for. The majority of these products of the World Statistics Day will remain usable in the future to explain official statistics to the public and build public support for statistical work. The videos are available on YouTube and on the website of the World Statistics Day (http://unstats.un.org/unsd/wsd/).

The Secretary General's overall evaluation of the day (2010) is that the World Statistics Day succeeded in raising the profile of official statistics in many countries and internationally. In addition to that, the increased awareness of the importance of official statistics among policymakers and the general public is expected to have a positive long-term impact on the development of official statistics. Furthermore, dialogue between different user groups was initiated, which is likely to continue also in the future.

A not so successful example of social media usage is the Facebook account of the International Statistical Literacy Competition. The main goal of the Facebook account was to arouse discussion amongst the students participating in the competition. In March 2011, the group had less than 90 followers, mostly country co-ordinators of the competition or employees of statistical offices. The postings of the group are mainly short news of the countries entering and students participating in the competition. Regardless of

marketing, the social networking between students from different countries did not succeed as planned. The reason for the passiveness on the Facebook might be due to poor planning and resourcing and, accordingly, lack of initiative of the account administrator. Maybe it is the ambiguity of the roles when students, teachers and statisticians are on a same platform. Alternatively, the important lesson here could be that such an account would rather serve as a closed platform for social networking and sharing of best practices for the people co-ordinating the competition in their countries. In the end, social media and interpersonal interaction are not in the hands of an organisation and hence cannot be controlled.
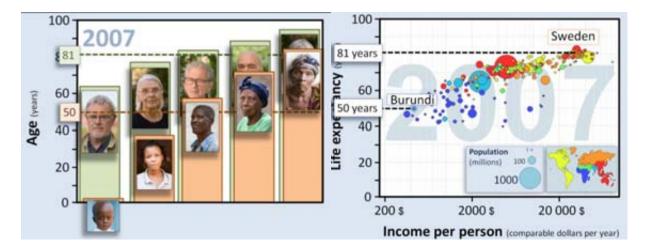
Visualisation tools to promote statistical literacy

In the world of numbers, new means are increasingly needed for dissemination and understandable analysis. Data visualisations show statistical raw data in an interesting way and communicate complex information and relationships in them quickly and clearly, thus also promoting the use of statistics. By visualising data on a map and with colours, and symbols of different sizes, the data can be looked at from multiple perspectives when compared to a plain table or text (Statistics Finland 2011).

During the past few years, the number of different data visualisation tools has increased significantly. Many national statistical offices have acquired tools that visualise data. Data visualisation is also increasingly being used in education and journalism to make the data both interesting and understandable. In the following section, four innovative tools are taken into a more detailed review. There are already some learning resources that are based on some of the following tools available but the tools can be used as themselves for educational purposes in any classroom environment where computers are available.
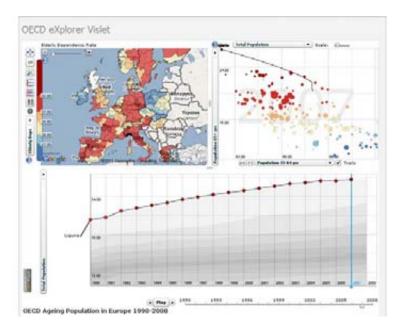
A current example of visualising raw data is the Gapminder World of the Gapminder Foundation (www.gapminder.org). The application contains statistical and historical data on the development of the countries of the world. The used information visualisation technique is an interactive bubble chart where every bubble represents a country and the colour defines the region. By default, it shows five variables: Two numeric variables on the X and Y axes, bubble size and colour, and a time variable that can be manipulated with a slider to play development over time. The user can choose the indicators and access the data on a spreadsheet. In addition, definitions and explanations as well as information on the source of the data are made available. (See e.g. Health & Wealth of Nations)

The Gapminder World website provides teachers with a separate "For teachers" section and has multiple video clips starring Han Rosling (see e.g. "200 Countries, 200 Years, 4 Minutes"). The "For teachers" section offers teachers ready-made teaching materials in English, such as "Life Expectancy Power Point" and "Gapminder Cardgame". The teaching materials include a teacher's guide for a lecture.

A picture capture from a Gapminder teaching resource that visualises life expectancies in Sweden and Burundi.

The OECD (OECD Factbook http://stats.oecd.org/oecdfactbook/) and many national statistical offices are using a flash-based tool known as Statistics eXplorer (http://www.ncomva.com/?page_id=485), originally developed by the University of Linköping, Sweden. Statistics eXplorer is an Internet server-based interactive statistics visualisation product that can be used for disseminating, analysing and sharing of regional data. The user interface consists of dynamically linked windows that enable the users to explore simultaneously spatial, temporal and multivariate data from different perspectives, and to explore changes in time with the help of animated time series. For a random user of statistical data the interface might seem complicated, which can be overcome by creating so called "vislets". Vislets are kinds of simplified windows to the service that can be embedded to the website of the service producer in question. By creating vislets, a national statistical office can choose the elements and functions shown to the users. (Statistics Finland 2011.)

A picture capture from an OECD eXplorer Vislet.

Statistics Finland used Statistics eXplorer "vislets" for disseminating results from the Parliamentary elections of spring 2011 (http://pxweb2.stat.fi/explorer/eduskuntavaalit_2011/index.shtml). See also the Italian National Institute of Statistics (http://noi-italia.istat.it/) and Statistics Sweden (http://www.scb.se/Pages/List____307244.aspx, http://www.scb.se/Pages/List____296469.aspx) for more examples.
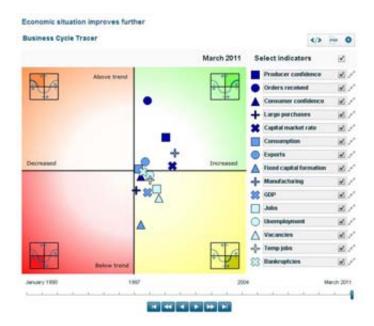
An example of a collection of indicators is the Findicator (www.findikaattori.fi) service that has been implemented as a joint project between Statistics Finland, the Finnish Prime Minister's Office, and various Ministries. The service contains approximately 100 indicators of social progress grouped thematically and by policy issue as per the Government Programme. Each indicator provides up-to-date information via tables, graphs and written analysis. In addition, links are provided to further information sources, metadata and international reference data.

Although the service does not contain any interactive elements, it has its strengths from the point of both the producer and the user. A major advancement of this service is that the most recent data for each indicator are automatically updated in the service as soon as they are released on the website. Another advantage of the service is that it is very simple and easy to use even for a random user of statistical information. The data are easily downloadable in different formats for further editing and analysis. Hence, the feedback from the users has been positive and statistics on the users show that educational institutions use the service regularly. The service is currently available in Finnish but a broader language selection is to be expected during the year 2011.

A picture capture from the Findicator visualises consumption of different energy sources.

An example of a recently improved visualisation tool is the Business Cycle Tracer by Statistics Netherlands (www.cbs.nl/businesscycletracer) that shows the monthly changes in the key economic indicators based on official data. The users can select the indicators and start an animation to trace the changes through time. In addition, a written analysis of the current situation is provided. The description and the cycle of separate indicators can be monitored using the Business Cycle Dashboard. A quite recent feature is the possibility to embed the Tracer to another website or save a PDF copy of it. A user guide and a video explaining an economic downturn with the help of the tracer is provided in YouTube, adding also an element of social media to the service. Even though equipped with a user guide and interactive elements, this service is clearly more difficult for random exploitation than the previously mentioned Findicator.

A picture capture from the BCT visualises the current economic situation.

Discussion

Social media and new technology are widely spread in our society and especially young people have adopted them quickly. In addition, the emphasis in teaching is experiencing a shift from static e-learning

materials to social, visual and interactive learning environments that are not dependent on space or time.

Social media clearly have both advantages and disadvantages for national statistical offices. As a new tool of communication, social media help to arouse awareness towards statistics but they also require resources, goals and clear strategies as shown by the examples in this paper. When entering social media, one-to-many communication turns into a many-to-many communication process that is impossible to control, as consumers become producers of the information. As the field of communications is changing, can Statistical Offices afford to make the decision not to enter social media? On the other hand, can they afford to go there and lose control of their before so controlled messages and target groups? Do social media have positive learning outcomes or will they be replaced with some new phenomenon once the hype is over?

The visualisation tools of statistics make data more interesting and hence make the adoption of complex information easier than plain textbooks and lectures. The ready-made learning materials based on Gapminder are practicable examples on how to use visual tools in a relevant context and thus support teaching in a classroom.

The examples in this paper are all interrelated in some way. Many e-learning materials, projects and visualisation tools do also appear in the Facebook or Twitter or provide users with webinars or YouTube-videos. Without a doubt, the existing e-learning resources have created a solid foundation for further development but there is still a lot to do. Social media and interactive applications can be expected to enhance learning as they enable learning by doing and using current, relevant and official data as raw material for the learning process. Still, there is a strong need to stress the demand for inter-branch co-operation between educational institutions, statistical offices, statistical societies, universities and business organisations to keep on the good work and bring the data alive.

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