PROMOTING STATISTICAL LITERACY:
A EUROPEAN PILOT PROJECT TO BRING OFFICIAL STATISTICS INTO UNIVERSITY AND SECONDARY SCHOOL CLASSROOMS

Hans-Joachim Mittag
University of Hagen, Germany
joachim.mittag@fernuni-hagen.de

Statistical literacy is part of the knowledge and information that represents a driving force in today's fast-moving globalised economies. For young people it is recognised as a key qualification for employability. In the academic world, the growing demand for an education in statistics is nowadays met by combining traditional ways of learning with web-based communication environments. Statistical Offices ought to play an important role in promoting statistical literacy, but most of them still have not considered this as part of their central function. This paper presents an EU-funded project that aims at promoting statistical literacy amongst young people by providing an innovative e-course with interactive and dynamic components. The project involved the National Statistical Offices of Malta and Finland and a German State University. The main aims were to encourage international cooperation between statistical agencies and educational institutions and to promote shared use of the project output.

STATISTICAL LITERACY AND ITS IMPORTANCE FOR OUR SOCIETIES

In the past, there have been lengthy discussions about how to define "statistical literacy". For Wallman (1993), statistical literacy comprises the ability to understand and to be critically aware with regard to statistical information and to appreciate the importance of statistical reasoning for decision-making in working and private life. Rumsey (2002) gives an overview on competing definitions and presents a slightly more extensive concept. She explicitly distinguishes between "statistical competence" or good "statistical citizenship" on the one hand and skills for carrying out basic statistical research on the other hand. The first level of statistical literacy in Rumsey's definition approximately covers the definition of Wallman and refers to properly understanding and applying basic statistical concepts. Rumsey's second level is built on the first level and addresses the ability to inquire, to probe, to base sound decisions on data and to comprehensibly communicate data-based decisions.

Anyhow, in today's knowledge- and information-driven societies, the need for attaining at least the level of being a good "statistical citizen" is indisputable. Young people lacking the attainment of this competence are more likely to be left in dead-end jobs. Hence, educational programs are needed to enable the citizens, in particular the young generation, to understand and to properly deal with the ubiquitous statistical information. Nowadays, the importance of statistical literacy as a key qualification for employability is widely recognized and policy makers and educational institutions have launched actions that aim at promoting it. This paper deals with an example of one of these actions.

PROMOTION OF STATISTICAL LITERACY AS A TASK FOR STATISTICAL OFFICES

About five years ago, most national and supranational statistical offices started to adopt a free dissemination strategy giving everyone open access to statistical information by making their products available online. This development has been mainly driven by advances in information and communication technology and as well by new demands and increased expectations of the customers. Making data freely available via the Internet attracted new customers, for example students from secondary schools or universities, and placed the data producers and disseminators under the spotlight. This development presented a window of opportunity not only to attain greater visibility in society as a trusted agent but also to become a key contributor to statistical literacy.

In Europe, a number of national statistical institutes (NSIs) have seized this unique opportunity and designed and provided free access to learning resources, usually presented online or on CD-ROMs, aiming at the promotion of statistical literacy. These projects contain the chance to build up closer partnerships between educational institutions and NSIs, besides that, to highlight

the role of statistical offices for the lay public through the use of official data illustrating basic statistical concepts.

Within the European Statistical System, an informal network uniting the NSIs of the EU-27 and EFTA regions and the European Statistical Office (Eurostat), Statistics Finland was a forerunner in supplying online products designed for promoting statistical literacy. About a half-decade ago, the Finnish NSI made available five online modules in the Finnish and English languages. The modules represent learning aids for students at secondary or postsecondary level and are labelled "How to read and use statistics", "Demography and population statistics", "Labour market statistics", "National accounts" and "Indices". An update is in the planning stage but for the time being, they still do not contain dynamic or interactive components. The Internet is only deployed for transporting static information. Another drawback restricting the use of the modules beyond national borders lies in the fact that for illustrating statistical concepts only national data are used.

Further educational online projects have been carried out during the past years by the NSIs of Portugal ("Local Action for Applied Statistics", ALEA), Lithuania ("Statistics at School") or Ireland ("Students Corner"). The core of the ALEA project is a static online course "Statistical concepts". This course is complemented by an online brochure dealing with data on Portugal and by a few fun elements (simple games, jokes related to statistics). The Lithuanian project addresses younger children (elementary school) and embraces animations with sound in Lithuanian language. The data used here are always national data. The Irish "Students Corner" is just a collection of static material related to national data, enriched by hyperlinks.

Overseas, some NSIs, in particular those of Canada or Australia, have already developed a rather extensive collection of online resources connecting official and educational statistics. The resources by Statistics Canada relate to different target groups and cover the wide range from elementary school ("Kid's Zone") to the postsecondary level. Even these online resources are far from exploiting the potential connected with rich virtual learning environments containing interactive or animated components and content-related discussion fora.

Within the European Statistical System, Eurostat would be a natural leader in co-ordinating the content development and the technical implementation of educational material designed for the promotion of statistical literacy on an international level. Until now however, Eurostat has not considered that as its core task and hence is still not an active player in this field. Nevertheless, Eurostat permanently works on improving the communication with the public. A step aiming in this direction was the implementation of a Wiki-type information portal ("Statistics Explained") in 2009. The goal of this portal is to explain European data sets in a comprehensible way to the lay public. The portal is mainly a dissemination and marketing tool for Eurostat's own data, not a tool designed for presenting statistical methods and for promoting statistical literacy.

DESIGN PRINCIPLES FOR AN EUROPEAN E-COURSE ON STATISTICAL LITERACY

As a Candidate for EU-membership and, since May 2004, as a new Member State of the European Union, Malta has been eligible for participating in Institution Building Programs funded by the European Union. In particular, Malta has benefited from programs aiming at capacity building for the NSO through provision of financial support, training or technical assistance. The NSO of Malta successfully applied, amongst others, for post-accession funds to be employed for the development of an online course to promote "Statistical Literacy". Using the terminology of Rumsey, the e-course was meant to focus on the provision of "statistical competence" or good "statistical citizenship".

The pre-defined timeframe for this project was very narrow and non-changeable. The project was due to start in January 2009 and had to be finalized by the beginning of December 2009. The project team consisted of two staff members from the Information Services of the Maltese NSO and myself as an expert for virtual statistics education working at a public university for distance teaching. The Finnish NSO was indirectly involved and provided valuable comments on the intermediate project output.
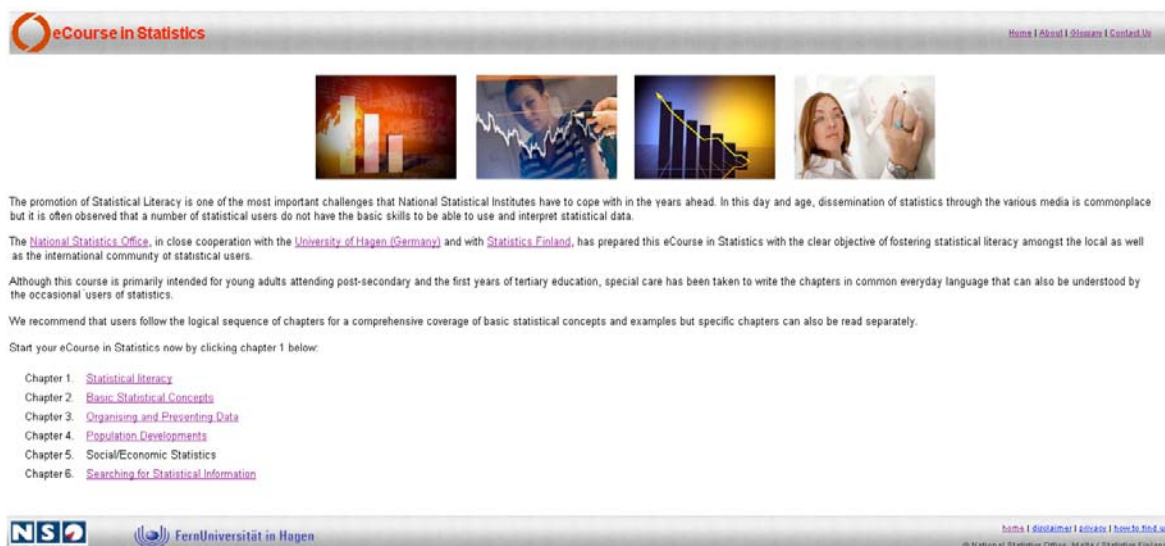
During a kick-off meeting in Malta, it was agreed that a major project goal ought to be the design and implementation of a prototypical online course for modern statistics education that:

- is tailor-made for use at secondary schools and during first year of university studies;
- addresses not only the young generation (14+) but also the European lay public at large;
- incorporates interactive and animated learning objects into hypertext environments, in the long run complemented by tutored discussion fora (blended learning approach);
- avoids re-inventing the wheel by systematically making use of open educational resources;
- is not confined to examples and data referring to only a single country;
- employs really motivating and relevant examples and data sets from official statistics and the media covering different fields of society;
- provides direct access to automatically updated data from the Eurostat database or databases from other supranational data producers;
- presents basic statistical concepts and as well their application in areas representing main fields of work in official statistics, such as monitoring and describing population developments;
- is designed for online use and avoids information overload on all screen pages.

Hence, an ambitious goal was to develop a non-commercial online course for statistics education that is designed both for a national and an international target group, in particular the young European public. Another objective of the project was to illustrate that a close co-operation between players from official statistics and academics is for the benefit of both sides. Building up a repository of self-contained learning objects for statistics education which is shared and maintained by a consortium of content providers could be seen as a medium to long-term objective.

COURSE CONTENT AND PRESENTATION OF EXCERPTS
The e-course is currently accessible at www.fernuni-hagen.de/statliteracy. It contains six chapters, each sub-divided into a few sections. Each section contains between 2 and 7 screen pages presenting small quantities of information (usually no need for scrolling of screen pages). To date, all chapters except one that will deal with social and economic statistics have been completed.

Figure 1. Overview on the content of the e-course

Chapter 1 defines what statistical literacy denotes and why it is an important topic for the young generation. Chapters 2 and 3 deal with elementary statistical concepts and tools, with emphasis on data collection and sampling methods or aggregation and visualization of statistical information. These chapters provide the foundations for data analysis and data communication in any application area of statistics. The visualization part takes recent developments in the field of data dissemination into account, such as the use of interactive maps for the presentation of spatial data.

Chapter 4 refers to demographic data and covers the aggregation of population data by means of indicators, for example life expectancy in Europe and other parts of the world. Again, interactive data visualization tools are employed. The last chapter is related to the promotion of information literacy that represents an important component of statistical literacy. It provides an overview on different types of data sources, informs where to search for statistical information and how to evaluate and cite available sources.

Figure 1 shows the home page of the course. The page is a hypertext that provides direct access to the individual chapters and to an extensive glossary as well.

The interactive and dynamic elements linked with the core text and as well the integrated web links to data producers are chapter-wise assembled and presented in form of a "media gallery". Figure 2 shows a sample page belonging to the chapter on population developments and, on the left-hand side of the screen, the media gallery affiliated to the chapter. The upper part of the gallery contains links to automatically updated Eurostat tables or graphs. The lower part displays links to other interesting sources, for instance to interactive population pyramids for selected countries or to a video dealing with the ageing population in Japan produced by the World Health Organization.

Figure 2. Sample page with media gallery

The media galleries for other chapters are currently less populated but will be complemented by new links to multimedia resources. Figure 3 shows a second sample page that incorporates an animation with sound dealing with a specific sampling method. The animation stems from a public German multimedia project "New Statistics". Here the gallery contains, for example, a link to a web site of the UN presenting the indicators employed for monitoring the achievement of the UN Millenium Development goals and for reviewing progress.

Another link goes to a press release that refers to the measurement of poverty and income inequality in Britain. The report has been misinterpreted by the media and serves as an example illustrating the need for being statistically literate. The gallery also includes an interactive visualization of a composite indicator employed by the Directorate "Enterprise and Industry" of the European Commission" for measuring and comparing the innovation power of European countries. The e-course illustrates by means of the popular example "Medal table of the Olympic Games" that the ranking of countries for a composite indicator crucially depends on the choice of weights for the single indicators. This explains why Statistical Offices are usually reluctant to officially employ these "synthetic indicators" as long as the weights are not data-driven.

Figure 3. Another sample page with media gallery

CONCLUDING REMARKS AND A PLEA FOR INTERNATIONAL CO-OPERATION

When drafting this paper, only a test version of the project output was available. The official presentation of the final version is scheduled for end of February and an in-depth discussion of the output on an international level is on the agenda of a Dissemination Working Group Meeting in Eurostat's premises in April 2010. A first presentation of the online course for mathematics teachers will be organized by the Maltese Ministry of Education during the summer holidays. Hence, the beginning of 2010 is too early for reporting on feedback but at the opening of ICOTS 8, first experiences should be available.

Due to the extremely narrow project timetable, the limited experience of NSIs with interactive or dynamic data visualization and finally due to lack of personal and financial resources, not all ideas could be implemented so far. Since the e-course has been designed as an open educational project for shared use, the development is intended to be continued and expanded with the support of new partners.

It seems to be indisputable, that e-learning and visual data communication addressing the needs of non-professional customers, in particular that of the young lay public, are increasingly important for any statistical office as components of a modern dissemination strategy (see Mittag, 2006). An intensified international co-operation in the field of statistics education and training between NSIs on the one hand and public data producers and universities on the other hand, contributes to avoid re-inventing the wheel and to minimize maintenance costs for shared open educational resources (Helenius, 2010). Hence, improved co-operation is also a requirement dictated by optimal allocation of personal and financial resources.

REFERENCES AND WEB LINKS

E-courses of the NSIs of Malta, Finland, Portugal, Ireland and Lithuania:
    www.fernuni-hagen.de/statliteracy
    http://www.stat.fi/tup/verkkokoulu/index_en.html
    http://www.alea.pt/english/
    http://www.cso.ie/studentscorner/
    http://mokyklele.stat.gov.lt/index.php?id=74

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