

Towards a Global Education in Official Statistics

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Abstract

In this paper we want to stress the relevance of designing a global educational strategy towards official statistics, whose quality should be based upon the simultaneous achievement of several objectives. The first one is the support of a network of qualified statisticians, grown from common quality standards as pursued by EuroSTAT with its EMOS (*European Masters in Official Statistics*) program, and ready to address the new paradigms and opportunities that come along the recent exponential growth of available data. Such EMOS program should be developed by selected Universities within a collaborative network, somehow supervised by National Institutes of Statistics, but also in collaboration with other private and state institutions that produce relevant social and economic data. Moreover, at the same time that human and updated technological resources are properly assured, a specific effort is needed in continuous education, in such a way that professionals in official statistics can periodically update their knowledge, by sharing problems and solutions with similar institutions and other research groups. Technical quality should come with specific social programs to assure the right influence in Society. This objective implies a strategy with secondary education (particularly to prepare teachers and give them support not only to educate in statistical concepts, but also to educate students in learning from data). Finally, a media plan is also needed, to be developed in collaboration with scientific associations, in such a way that official statistics gets closer to Society, both in appreciation (as a reliable direct source of knowledge) and understanding (and avoid a tricky world under mathematical and statistical *illiteracy*).

Keywords: Education in Statistics, Science, Society, Statistical Institutions.

1. Introduction

A main characteristic of the intelligent management of any community or organization is to prepare its own future, which might imply specific actions far beyond such a community or organization. Sometimes we have to push certain ideas, technologies or structures into the

whole Society, so our vision is possible to be approached in the future, perhaps when we have no longer responsibility within that community or organization. Promoting flexibility and increasing capabilities that will help Society to be ready for new circumstances, partially guessed and partially uncertain, is part of our responsibility as members of public system. This is especially important in times of social change: the rise of Network Society. Meanwhile we have to manage problems with the tools and resources currently available.

Managing a community implies keeping a balance between the present and the future, between current reality and a vision about the place we want to stand later so those coming after us will be able to build or resist what we had not been able to build or resist. Evolution cannot stop in a changing world that comes with uncertainties, risks and opportunities. Each community or organization should design some kind of strategy from the solid ground of its strengths, by enhancing individual abilities and social adaptability, to drive the society towards a more just and equitable future. A percentage of our professional activity should be devoted to explore new possibilities as part of a continuous formative process.

The above arguments are rather general, but contain basic principles for any community and organization. The evolution of species can be viewed as a natural way of finding an equilibrium between the promotion of individual skills and adaptability, assured by a reproduction system that guarantees some heterogeneity (a group with only optimal individuals today might disappear if the environment abruptly changes). But a human community willing to be called *intelligent* needs a strategy to allow a successful evolution from the heritage received from the past, defined by its current structure and culture. Such a strategy essentially depends on the members of the group, who become the most important value of any community, and how they are organized according to their resources. Today we can do only those changes that have been somehow prepared from the past. A group can only grow from their individual and social capabilities, and their resources. Our role in that process, as members of the educational system, is one of the milestones of University Social Responsibility.

Building up Europe implies addressing a tremendous amount of issues to harmonize. Europe represents a long and risky project that touches all aspects of a huge and complex Society (not only economic or political, but mainly organizational and even cultural or emotional, so people from different countries and regions accept to become part of a joint project, and that key problems have to be faced together, implementing the principle of subsidiarity within a global interest).

A small piece of such a needed harmonization in Europe is Official Statistics. No Government can make intelligent decisions without reliable data. EuroSTAT was born to serve this objective, and the production of official data is being continuously improved under EuroSTAT guidance. Key aspects in this project are education, organization and infrastructure (see <http://ec.europa.eu/eurostat/web/europe-2020-indicators/europe-2020-strategy>). In fact, the essence of Official Statistics is the design of a systematic observation of Society and its evolution, and produce useful tools for understanding so policies at different levels can be supported on reliable public information.

This paper pursues to stress the relevance of the EuroSTAT *EMOS program* for a network of European Masters in Official Statistics (see <http://www.cros-portal.eu/content/emos>), and to present the new *Master in Official Statistics and Social and Economic Indicators* being launched at Complutense University, Madrid, Spain (see <http://www.ucm.es/emos>). This Master in Official Statistics has been specifically designed to introduce the future official statisticians in the new paradigm imposed from a Society where the electronic trace of observed acts is increasingly covering everything; the so-called “network society”. Because due to the magnitude of the object under study, the whole Society, Official Statistics needs extremely efficient processes, to obtain the maximum administrative information with the minimum effort from those providing the information. A main objective within Europe is statistical standardization, which requires the implementation of international classifications, needed for any reliable comparison or verification process, and the analysis of the evolution in time of any indicator.

But before presenting our view of the official statisticians we pursue, let us address first the relevance of the education in Science (section 2), and the relevance of the education in Statistics (Section 3). We will then focus on the relevance of the education in Official Statistics (Section 4) and describe the main characteristics of the Master in Official Statistics at Complutense University (Section 5). A final Section 6 will offer a rejoinder of the main ideas in this paper.

2. Education in Science

Although the main objective of this article is to stress the relevance of a strategic investment on education in Statistics, and in particular about the absolute need of preparing future official statisticians for the change of paradigm going on, we want to stress first that this objective should be viewed as part of an education in scientific methodologies (please remind recent editions of the classical works of Feyerabend, 1993, Khun 2012, and Popper, 2002). Our scientific discourse should be not only *somehow logical*, but also based upon *observations* and *somehow tested* when new information arrives, so we can learn from that process. Modern Society is expanding this scientific approach to problems, of course not discarding the inherent emotive component in any human dispute (they are quite often part of the problem).

Indeed, the social prestige and impact of Science has expanded in the last 50 years. Society is everyday acknowledging the value of its methodologies in every field, from Experimental Science to Social Sciences, but not restricted to them (the analysis of vehicular language is a hot topic in Computer Sciences, with direct implications in technology once an essential part of the information we manage is based upon words and discourses, but see e.g. Montero, 2009). Science has also shown the strategic value of non-oriented research, and the importance of certain attitude for adventure and discovery in order to improve and grow.

3. Education in Statistics

One of the problems education for Science should address is the ability to produce manageable information, and the ability to understand such an information to bring practical consequences. Otherwise our learning process cannot be guaranteed, and Society can be easily manipulated

within a false but apparent objectivity (please remind the classical book on mathematical illiteracy by Paulos, 2001). The most important contributions of Statistics are in fact the design of the experiment (how reality should be observed in order to obtain relevant data), and how obtained data can be presented (so decision makers can take their decisions based upon that information).

Much effort is needed to increase the ability of students in secondary education to produce, manage and understand statistical data in their future daily life. The battle for Mathematics seems to be won at this educational level: modern Society acknowledges the importance of mathematical education as a main language for knowledge, just after vehicular languages. But the presence of Statistics in secondary education is still too low. In fact, the experience today is that a basic knowledge of Statistics is needed to understand the information we receive by means of media. The perceived impact of Statistics in daily life can be greater than other branches of Mathematics. Still, the ability to understand statistical data after secondary education seems rather poor. More initiatives are needed to solve this educational problem. For example, the National Institute of Statistics in Spain (INE), together with the Faculty of Statistics at Complutense University and the Society of Statistics and Operational Research (SEIO), launched in 2013 the *Statistical Olympics* conquest, now in its 4th edition, an initiative that pursues the promotion of Statistics at basic levels of education (see in particular http://www.ine.es/explica/olimpiada2016_inicio.htm). Another interesting initiative being promoted at Complutense University is the *incubator of surveys and experimentation* conquest (see <http://estudiosestadisticos.ucm.es/idsye>). These kind of initiatives within students at secondary education are extremely important since they help teachers to put in the young students the interest for certain abilities that for sure will need to understand Society when they grow up (needless to remind the increasing relevance of Mathematics and Statistics, but also Computer Sciences, within every professional activity). Another particularly interested initiative in Spain, among many others, is the Mathematical Spring Conquest organized by Puig Adam Society of Mathematics and Complutense University (see in particular http://www.sociedadpuigadam.es/primavera/index_nuevo11.php), with more than 51.000 participants in its 20th edition this year.

4. Education in Official Statistics

Official Statistics plays an important role in modern Society. Partially as a consequence of the culture of Science, people want opinions based upon data. In this way, the access to those ground data represents a social demand, not only claimed by specialists. For this reason it is more and more import to take into account the stakeholders of the official statistical system. That is, for example, experts and academicians, politicians, journalist and the society in general terms.

Moreover, the new paradigm in Official Statistics is similar to the new paradigm in many other fields: if strategies should be based upon data and predictions, modern Society is exponentially increasing the amount of available data. But lately, in many cases the cost of designing a poll is by far bigger that the cost of analysing the tremendous amount of available data. Reality is increasingly being electronically observed and recorded (mobile phones, electronic cards, energy consumption, sensors is roads and streets, cameras, social networks, internet search, etc.) We are leaving everywhere an electronic track of our activity.

People in democracy should learn the basic tools to live in democracy, and this implies education and some knowledge of all key general fields in order to be able to properly manage within Society. A good educational system is essential in a democratic system. Freedom might be useless without education. People should be able to somehow test the reliability of the different opinions reaching to them. Moreover, democracy stands over people that support investments, and it needs information and confidence (see, e.g., Montero, 2009).

Education in Official Statistics implies the acknowledgement of official statisticians as specialized technicians that intend to produce trustable data no matter the circumstances. Main social and economic studies coming from official institutions should pursue a wider distribution within Society, not restricted only to specialists, and assure the institutional prestige that Official Statistics needs. This can be done only if people has some knowledge of the relevance of these studies for their own life. Like any other economic or social activity,

Official Statistics needs also a media plan to get the right social perception of its professional activity. In addition, this education will encourage a collaborative participation when needed.

But Official Statistics address the Society as a whole, and it cannot be viewed as a specific field of Mathematical Statistics. The problems addressed in Official Statistics are multidisciplinary in nature, and official statistician need a deep enough knowledge of the complex reality they are facing to. Being an official statistician means a professional with certain abilities to manage big amounts of data, implying at a first stage Statistics, Mathematics and Informatics. But that information reaching to an official statistician is complex, data might come in several formats (not only numerical), and simultaneously implying concepts from Economy and Sociology, and also other concepts usually studied within Human Geography, Psychology and Law at different levels, among others. An official statistician needs a multidisciplinary background, profile that with no doubt opens a wide professional framework of expertise.

A general description of the needs of future statisticians can be obtained surfing EuroSTAT web site (see <http://ec.europa.eu/eurostat/web/main/home>). Open courses and useful material are being offered by EuroSTAT, particularly around the EMOS program and its associated masters (see http://ec.europa.eu/eurostat/cros/content/emos_en). Within Spain, a main reference should be Statistics School organized by the National Institute of Spain (INE, see <http://www.ine.es/>), and in particularly its open formative offer being offered at http://www.ine.es/ss/Satellite?L=es_ES&c=Page&cid=1254735801161&p=1254735801161&pagename=FormacionYEmpleo%2FINELayout (see Martínez de Ibarreta-Veira, 2016, also in this conference).

5. Master in Official Statistics and Social and Economic Indicators at Madrid

Having in mind the above considerations, the Master in Official Statistics and Social and Economic Indicators has been created to meet with flexibility all the requirements needed by professionals in Official Statistics. This is:

- Offering advanced training in classical and current statistics techniques.
- Improving the capabilities of future experts in official statistics on the main social, economic and political issues that affect European societies, as well as the main tools and indicators our disposal to measure these processes.
- Creating a context in which technical issues related to the statistic are closely related to the ethical dimension of this professional activity.

However, as noted above, it is important that the official statistic take into account the stakeholders. In this sense, our Master has reserved part of its schedule to open "complementary training activities" to the Masters students but also for members of the various communities (journalists, politicians, experts, etc.) for whom the official statistics is a valuable resource.

To do so, we include in our program the suggestions from the EMOS board:

- A 2-years master build from a multidisciplinary conception, with the participation of 8 Faculties: Mathematics, Economics, Statistics, Sociology, Geography, Psychology, Informatics and Law.
- Including a first semester with different courses for each student, to assure key knowledge not being acquired in their previous grade studies (a number of courses on Mathematics and Statistics is a must in all cases).
- Including a mandatory internship in some institution producing Official Statistics, particularly the National Institute of Statistics in Spain, INE (agreements are being promoted with all the institutions in Spain directly in charge of producing Official Statistics).
- Including the EMOS module with the main parameters of Official Statistics, totally taught in English.

- The possibility of expending 1 semester in one of the EMOS masters around Europe (agreements with all these Universities with EMOS master are being promoted).

But we also include other activities as:

- A leveling course for students with different educational origins. These courses will make possible that all students acquire the basic training required for the Master.
- Complementary training courses, for example, to train journalists and journalism students in the proper use of official data or to train senior government officials in handling new techniques such as big data applied to the official data sources.
- Regular meetings with representatives of Ministries of the Spanish Government and the Central Bank of Spain to collect their views on the official statistics needs and try to bring them to the Master curriculum.

The pursued heterogeneity of students, coming from different scientific fields, represents an added value for the students themselves. Classes will be scheduled late in the afternoon to allow the participation of more students having a job, and Friday afternoon will be devoted to offer attractive complementary courses and conferences by qualified practitioners of Official Statistics, open to professionals not following the Master but willing a continuous formation in this field (and including aspects not in the core of an official statistician, like for example how to prepare a note for media). Moreover, an annual Meeting in Official will be organized, starting this year with the participation of top professionals coming from the Government of Spain (Ministers of Agriculture, Economy and Employment), the National Institute of Statistics in Spain (INE), the Center of Sociological Researchers in Spain (CIS), and of course from Complutense University.

Complutense University, with more or less 80.000 students, has the wide profile of top specialists that such a multidisciplinary teaching needs, and students can take advantage of the economic and social active in Madrid region. Around 2.000 Complutense students join the ERASMUS program every year, and we have more than 1.500 ERASMUS visitors per year.

6. Conclusion

In this paper we have stressed the relevance of Education in Science and Statistics as a main strategic objective for the whole Society, and particularly as a key element for the construction of Europe. The *EMOS program* launched by EuroSTAT represents in our opinion a milestone, since it is preparing the background of the statisticians to be in charge of future statistical offices around Europe. This formative approach will make easier the harmonization of different systems, and will be very helpful to develop legislative changes. Moreover, we have stressed the need of a multidisciplinary education of the future official statisticians within the new paradigm of data scientists.

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References

- Feyerabend, P.K. (2010), *Against method*, 4th edition, Verso, London
- Montero, J. (2009), *Fuzzy logic and Science*, *Studies in Fuzziness and Soft Computing* 243:67-78.
- Kuhn, T.S. (2012), *The structure of scientific revolution*, 4th edition, University Chicago Press, Chicago.
- Paulos, J.A. (2001), *Innumeracy, mathematical illiteracy and its consequences*, Hill & Wang Publishers, New York.
- Popper, K.R. (2002), *The logic of scientific discovery*, Routledge, London.
- Martínez de Ibarreta, T., Veira, F. (2016), *Statistical training as a factor in quality*, European Conference on Quality in Official Statistics, Madrid, Spain, 31 May-3 June.