CO-OPERATION WITH EDUCATIONAL INSTITUTES AND PROMOTION OF STATISTICAL LITERACY

A – INTRODUCTION

Statistical information is nowadays an essential form of knowledge necessary for full citizenship. However, statistical users must be provided with tools to decipher the specific language of Statistics.

Young people, in particular, must be helped to overcome their reluctance to deal with this subject and become critical and responsible users of statistics. The reading of statistical information needs the understanding of the concepts and methodologies used in its preparation.

In carrying out their activity, Statistical Offices are responsible not only for producing, disseminating and analysing statistical information but also for ensuring that this information is well understood by the users.

Therefore, statistical thinking or reasoning will come before statistical methods.

Following Smith (1998), good statistics should, of course, be identified with purity and mathematical precision, but they should also be associated with “careful thinking“.

Creating experimental and learning environments based on ICT, namely through the analysis of real data is an important way to improve the statistical thinking and reasoning, as well as **technological literacy**.

Usually Statistics pedagogy is said to follow four paradigms:

1. Statistics as a branch of mathematics;
2. as data analysis;
3. as experience planning; and
4. as a problem-based matter.

Traditional statistics teaching focuses on the first three aspects. However, statistical reasoning must come before statistical methods. It is not advisable to present statistics at the introductory level as a branch of mathematics. Good statistics should, of course, be identified with purity and mathematical precision, but it is also associated with careful thinking (Smith, 1998).

The failure of many introductory courses in Statistics has led certain authors to the belief that they should be redirected - from mathematical technique to data analysis.

There are also those who defend changes in teaching methods, replacing passive lessons with lessons in which the students take an active part.

The use, as a supplement to theoretical lessons, of a sequence of group projects with oral and written reports on the results obtained is one of the solutions tested (Smith, 1998).

The process of writing about a subject may reinforce and clarify its understanding. It is useful for the projects to be presented by the students to include the proposed objectives, an indication as to how the data was obtained, presenting data-based inferences and finally, questions or reserves concerning the conclusions found.

To promote the statistical literacy of the media workers must be another important objective to all statistical agencies.

B – CO-OPERATION WITH EDUCATIONAL INSTITUTES

The co-operation with Educational institutes is an important issue to the development of the statistical systems in both the reinforcement of the technical capacity to the production of official statistics and the promoting of statistical literacy.

After 1990 Statistics Portugal begins to permanently co-operate with high school institutions.

In particular, Statistics Portugal as supported in co-operation with one of the Portuguese Universities (Universidade Nova de Lisboa), the creation of a new Institute

(ISEGI) which aims is to provide university level education in statistics and information management.

At the time the main objective of Statistics Portugal was to reduce the shortage of staff with specific training in statistics.

This specific training in statistics must be multidimensional in the sense that the teaching process includes, as far as possible, the use of concrete statistical data as support to theoretical analysis.

After all these years, ISEGI has played an important role to Statistics Portugal as provider of courses and seminars on statistical methodology and techniques.

The co-operation Statistics Portugal / ISEGI is now initiating a new cycle which we hope will include not only the reinforcement of statistical training but also the training in Geographic Information Systems and Science, which is the first formal graduate degree in Portugal that completely uses e-learning technologies and teaching methods.

In terms of legal framework, the existence of a General Council[1] that follows and approves ISEGI's activities and elects its Director makes ISEGI a unique case in Portugal.

Statistics Portugal has been one of the most active partners of ISEGI from its beginning especially as a member of the Association for the Development of ISEGI (ADISEGI)[2], an ISEGI strategic partner since 1990 that has increased its membership with SAS Institute and ESRI Portugal since 2000.

In order to widen and attract better undergraduate students, ISEGI involved current and former students, high school teachers, society stakeholders (ADISEGI members) and faculty in a strategic exercise. This resulted in a strategic plan that is currently being implemented and already with positive results.

> ISEGI will seek to slowly increase membership in ADISEGI namely with software developers in the information systems area. Partnerships are also sought and under development with similar and complementary institutions for research and joint graduate programs, especially within European Union and Portuguese speaking countries.

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[1] The General Council has the following composition: UNL Rector, ISEGI Director, President Instituto Nacional de Estatística, 3 members from ADISEGI, 3 external Professors, President of ISEGI Scientific Council, 2 Professors from ISEGI Scientific Council, President of ISEGI Student Union, 2 students elected from the Pedagogic Council, Director CESD – Lisboa, 1 Member from Conselho Superior de Estatística.

[2] ADISEGI is composed of the following institutions: Accenture, Banco de Portugal, Companhia de Seguros Mundial-Confiança, Companhia IBM Portuguesa SA, Electricidade de Portugal EDP, ESRI Portugal – Sistemas e Informação Geográfica SA, HP, Instituto de Apoio às Pequenas e Médias Empresas e ao Investimento - IAPMEI, Instituto Nacional de Estatística, SAS Institute and UNISYS – Sistemas de Informação SA.

Another side of the Co-operation between Statistics Portugal and Educational Institutions, concerns the support of some institutions to concrete statistical projects and also to the dissemination of official statistics.

Actually the co-operation process with Educational Institutions includes 35 High – Schools from different Universities and around the same number of polytechnic schools.

Some of the most important co-operation projects with the High Schools concern the innovation in terms of methodology and data collection and analysis.

With polytechnic schools the co-operation concerns essentially the support to the dissemination of official statistics.

C – PROMOTION OF STATISTICAL LITERACY

1) The teaching of statistics in Primary and Secondary Schools

Statistics Portugal is aware of the importance that the Teaching of Statistics encompasses in Primary and Secondary Schools. It is, in fact, one of the most important instruments in promoting statistical literacy.

After analysing the curricula of several introductory courses in Statistics, we observe that Statistics is often seen as a branch of Mathematics rather than a problem-based matter.

There are indeed courses in which it is suggested that the students read the texts before the lessons, during which only questions regarding the data sets to analyse are discussed. From this perspective, lesson time is used to discover statistical principles and apply statistical techniques. Thus, the students are asked to analyse and use authentic data, some gleaned from available sources and other through class surveys or experiments.

In Portugal, the teaching of statistics was recently included in the O-level (third cycle of basic level corresponding to 7th, 8th and 9th years of school) mathematics syllabi. The mathematics programme of the A-level (secondary level corresponding to 10th and 11th years) included statistics already. Elementary topics such as the gathering and organisation of data, data representation and interpretation, measures of central tendency and probability calculation are taught at primary school (first and second cycles of basic level corresponding to 1st to 6th years of school), while secondary level students are introduced to more elaborate concepts such as probability concepts and inductive statistics. Developing the statistical reasoning of students consists of incorporating active learning strategies that make it possible to supplement what they have heard and read on Statistics and actually produce statistics.

This development encouraged us to reflect on the usual introductory courses in statistics. We aimed at creating a new project based on statistical data and problem-based matter that takes advantage of its complementary character in relation to the classic concept of the lesson. Simultaneously, as it uses new information technologies, it is equipped to adapt to the new paradigms of teaching statistics. Therefore, the ALEA project was created. We introduce it in the next section.

2) Statistics as a problem-based matter: the role of ALEA

In Statistics Portugal many efforts have been made in last years with the aim of improving statistical literacy. In 1999, as an answer to the requests of the educational communities, a new project was set up for the specific purpose of providing tools related to the understanding, using and teaching of statistics. The ALEA (Local Action of Applied Statistics - www.alea.pt) is aimed essentially at primary and secondary schools, but it is also an important resource for supporting interdisciplinary projects, being, simultaneously, of benefit to many other groups of people[3].

ALEA is to be viewed as a project which aims at providing both teachers and students of primary and secondary education with teaching materials for the study of Statistics.

[3] It is worth to mention that ALEA won the Best Cooperative Project Award conferred for the very first time by the International Association for Statistical Education – IASE. The prize distinguished the partnership among institutions committed in the promotion of statistical literacy in Portugal.

These materials include a web page containing several educational resources, “statistical” entertainment, and downloadable material. This project is a joint idea of the Statistics Portugal and Tomaz Pelayo Secondary School, bringing together The Portuguese Ministry of Education and the Statistical office.

The ALEA project includes several online resources, CD-ROM, paper publications, b-learning training courses, workshops, etc., covering different topics, from statistical theory, real data and class-room problems to entertainment, games and jokes.

Two statistical courses are available online: “Statistical concepts” which presents elementary concepts of descriptive statistics and “Probability concepts” which provides concepts and exercises on probability. E-learning environments were also created, based on the two statistical courses available in ALEA. Other online resources are included, such as statistical information about Portugal (until county level), the European Union (with interactive maps and statistics for all countries) and an interactive statistical summary of the countries having Portuguese as the official language. . ALEA’s home page is presented in Fig. 1.

Fig. 1 – ALEA Home page

A set of handbooks (Dossiers & Resources) dealing with specific topics, such as Environment Statistics, Census, History of Statistics, Statistical Software, Surveys, etc. is also available. There is also a special area for entertainment (Fun with Statistics!) with several games and cartoons; the Challenges, a competition where students may participate; Focus on Statistics, a page containing news with a statistical content found in the press, and a section named “Facts & Names in Statistics”, with the most

significant names and dates of the history of statistics. There is also a special area (Your Surroundings – see Fig 2) where the users can choose a territorial area (from the whole country to a single county) and see statistics for that particular geographical unit. There is also a page reserved for publicising the best reports handed in by the course students - after being duly 'filtered' by the teacher

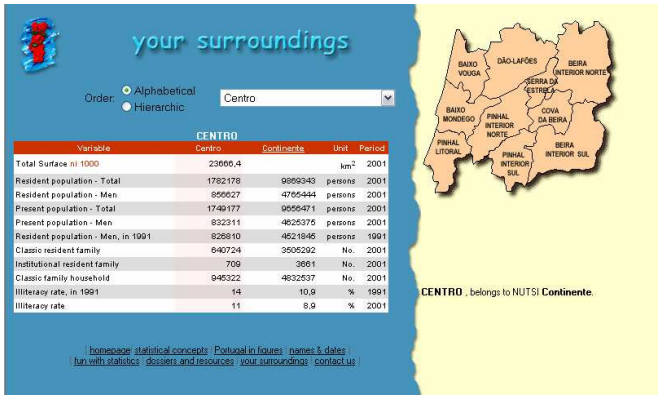

Fig. 2 – "Your Surroundings" – Georeferenced data at your fingertips

Geography, Economics, History, Sociology are some of the subjects for which ALEA has specific contents. In what concerns Mathematics, topics such as Descriptive statistics, Graphs (Histograms, Bar plots, etc.) and Probability and Inference Statistics are covered by ALEA with some detail.

3) Recent developments towards the promotion of statistical literacy

Statisticians are well aware of how the media can sometimes misinterpret statistical data. ALEA therefore tries to stimulate users' understanding of statistical information in the media, with analysis and comment of texts extracted from newspapers and magazines. As mentioned above, the reading of statistical information needs that the reader understands the concepts and the methodology used in its preparation. That is indeed something that Statistical Portugal is committed to do, in order to promote the increasing of statistical literacy.

Therefore, one particular resource that has been introduced recently is ALEA's Challenges. Being often used by both teachers and students, ALEA's Challenges is a Portuguese language competition containing everyday life problems based on daily

news. It is oriented towards the Primary and Secondary students aiming at increasing the reading ability of tables and graphs.

Another resource we have made available recently is ActivAlea. ActivALEAs are learning-by-doing assignments containing tasks, comments and self-test questions in order to systematize the basic statistical concepts in the classroom. The idea behind ActivALEAs is that sometimes you do not how to accomplish a trivial task in statistics. For instance, the graphical presentation of information is very important in Initial Data Analysis and one must be aware of the main characteristics of the data in order to proceed with more sophisticated statistical techniques. However, you do not have to read an entire book on introductory statistics if you want to produce a bar chart or an histogram. For that purpose, we developed small sheets containing short explanations for some frequently asked questions in order to systematize the basic skills of statistics.

We are also creating a prize for the best statistical project. It is a competition that aims at promoting the collection and analysis of data, as in the spirit of *thinking with data*. Following Snee (1993), "*Data collection and analysis is the heart of statistical thinking. Data collection promotes learning by experience and links the learning process to reality"*. The works submitted to competition take on the form of projects providing the students with experience in formulating questions, defining problems, formulating hypotheses and operational definitions, planning experiments and surveys, collecting data and, regarding the best way to deal with measurement errors, draw up data summaries, analyse them, how to communicate discoveries and plan experiments and how to correlate the ideas suggested by the discoveries.

We are also starting a new area devoted to the basic learning and teaching of Statistics (1st to 4th grades) in order to provide resources that are useful to teachers. As data analysis is getting more and more importance in the curriculum of these levels of education, ActivALEA's 6 (Frequency tables) and 7 (Bar charts) have already been created with this purpose.

Also the visits to Statistics Portugal by students of different institutions are used to promote statistical literacy.

Some references

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