USING WELL-BEING MEASURES TO PROMOTE STATISTICAL LITERACY

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This paper describes and discusses an activity proposed to secondary school students to experience the process of measuring well-being of society. The suggestion is part of a series of initiatives conducted by the Italian National Institute of Statistics (Istat) to promote statistical literacy among young people. Students are required to reflect about well-being concepts, to operationalize well-being dimensions, to analyse and interpret well-being data, and to verbalise their statistical analysis. Data sets come from the Istat's "Report on equitable and sustainable well-being" (BES) and contains over one hundred indicators concerning the fundamental dimensions of well-being and progress in Italy and its territories. Retracing the path to define and measure well-being, students become familiar with these issues and using real data they anchor the learning process to everyday life.

THE BACKGROUND

Over the last twenty years Italian National Statistical Institute (Istat) has given increasing attention to promote statistical literacy. Katherine K. Wallman (1993), in the speech she delivered when she became President of the American Statistical Association, defines statistical literacy "the ability to understand and critically evaluate statistical results that permeate our daily lives – coupled with the ability to appreciate the contributions that statistical thinking can make in public and private, professional and personal decisions". The ability to understand statistics is a prerequisite for a successful communication with the users. Consequently the role of a statistical organization has been changing. It's no longer enough just to collect and produce statistics, but we have to: understand the needs of our diverse user community, improve our dissemination processes, raise awareness of the value of these statistics, and actively encourage their informed use (Unece, 2014). To increase statistical literacy, Istat realised several initiatives in all fields of society: for scholars and students, for journalists, for decision makers in politics and businesses and overall for the general public.

To make the most effective action throughout the national territory, a territorial network of experts from Istat offices was set up in 2013 and still continues to operate in a synergistic way (Figure 1).

This paper illustrates an initiative aimed to promote statistical literacy among secondary school students (aged 15-18 years). For a National Statistical Institute (NSI), promoting statistical culture to secondary school students means:

- To make students familiar with the potential of statistics, in particular with official statistics;
- To make students familiar with NSI activities and publications;
- To show students how to retrieve official statistics using NSI website and databases;
- To explain how to read and correctly interpret statistical data, avoiding typical abuses or misunderstandings of statistical concepts and data;
- To support the teaching of statistics by concrete experiences, new tools and innovative ideas tested in the institute.

Guiding students to reason using statistical ideas and make sense of statistical information, Istat contributes to the development of students' statistical literacy.

The activity proposed to the students is based on two key points:

- The experiential learning based on the "learning by doing" approach, that replaces passive lessons with lessons in which the students take an active part;
- The use of real data, that connects statistics to the real word and encourages students to question about the world in which they live.

The topic chosen for the project goes back to an initiative supported by Istat in collaboration with the Italian National Council for Economics and Labour (Cnel): the Equitable and Sustainable Well-being Project (*Benessere Equo e Sostenibile*, BES Project) (Giovannini &

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Rondinella, 2012). The project aims to measure the level of well-being through the analysis of relevant aspects of the citizens' quality of life but also its equity in terms of distribution of the determinants of well-being between social groups and its sustainability, considering if the same level of well-being can be guaranteed to future generations. The project is part of the international debate on "GDP and beyond" and is based on the central idea that economic parameters alone are inadequate to evaluate the progress of societies and should be complemented by social and environmental information and by measures of inequality and sustainability (Hall et al., 2010). Istat, together with representatives of the third sector and civil society, has developed a multidimensional approach to measure well-being, integrating the indicator of economic activity (GDP) with measures of basic social and environmental dimensions of well-being, together with measures of inequality and economic, social and environmental sustainability. The project identified 12 domains of well-being: health, education and training, work and life balance, economic well-being, social relationships, politics and institutions, security, subjective well-being, landscape and cultural heritage, environment, research and innovation, quality of services. The indicators are produced in a dashboard that provides a shared view of the progress of the Italian society (www.istat.it/it/misure-del-benessere). Moreover, with the reform of the Italian budget law, the indicators of well-being became an evaluation tool of economic policy measures, like GDP and the labor market indicators.

The activity proposed by Istat researchers to students of some secondary schools of Liguria consists in tracing a similar process to that Istat and Cnel have carried out to identify the well-being measures and then using BES data to analyse life quality in Italian regions. Through this exercise students experience:

- What is the BES project;
- How and how well BES indicators are useful to understand the world around us;
- How and how well BES indicators are appropriate to design, monitor and evaluate policies.

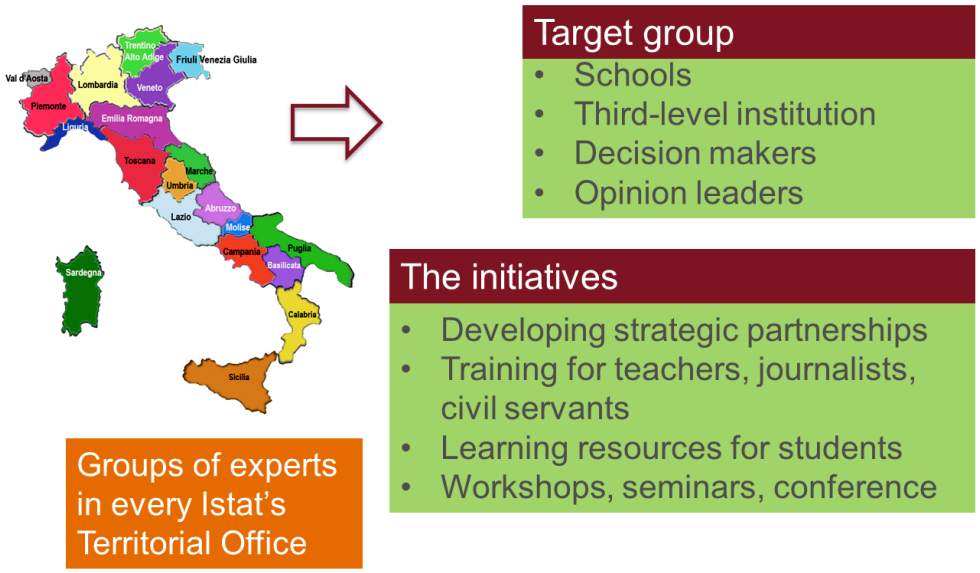

Figure 1. The territorial network to promote Statistical Literacy

THE STATISTICAL EDUCATION PROJECT WITH BES

The statistical project is organized in two phases:

- In the first phase, the students identify well-being domains, compare their modelling to the official modelling and try to find suitable progress measures;
- In the second phase, students analyse BES data and interpret their findings.

Well-being is a multidimensional concept, it is an abstract construct and it is impossible to observe it directly. To measure well-being, it is necessary to define it and this measure has to be accepted and recognised by the participating stakeholders. The concept of well-being must reflect and take into account the various aspects of contemporary society. For this reason Istat and Cnel

established a steering committee with the participation of 33 stakeholders' representatives (entrepreneurs, unions, non-governmental organizations) and Istat experts to identify the domains and to agree on the final list of indicators. Moreover in 2011 Istat has entered into a multipurpose survey on households "Aspects of daily life" a form asking citizens what really matters to them. The respondents had to provide a score from 0 to 10 to a list of 15 conditions corresponding to the same number of well-being dimensions. This survey was conducted on a sample of 45 thousand people aged 14 years or older, representative of the population resident in Italy, and gathered the opinions of all sections of the population on important dimensions relevant for well-being, representing a unique case in the international scene. The broad-based consultation process extends the democratic basis of the set of indicators and also awakens interest in the process among the public and encourages them to express their ideas about progress.

Students are invited to go through the same process, answering the question "What really matters to you? Write on a sticky note the three most important aspects that contribute to your well-being and hence to the well-being of society. " Then each student attaches its own note on the board and reads it. The next task for the students is to synthesise the concepts expressed on the notes in domains that describe well-being. For each domain, the students identify the aspects which contribute most to define the individual and social well-being. According to Alkire (2002) the set of domains that define progress should be incommensurable – none of the qualities of one domain should be present in another; irreducible – it should not be possible to make the list any shorter; non-hierarchical – they cannot be arranged in any permanent hierarchy, because at one time any of this dimension can seem the most important.

This activity involved the students in the construct of well-being and its definition. As they have their own knowledge about this construct, they themselves can contribute to define it. In this process, the students also experience how to operationalize a concept, moving from an abstract concept to its operational definition. In the next step with the students, the dimensions identified by them are then compared to the 12 domains of BES and the dimensions identified within each domain from Istat and Cnel. In experimentations conducted in groups of about 60 students, they have always identified and shared the fundamental aspects of BES. The most recurrent words are health, family, love, friends, money; further frequently names issue were dreams, freedom and sport. The differences between the domains identified by the students and the BES domains are discussed by the students supervised by the Istat's researchers.

After identifying the wellbeing operational concepts, it's possible to proceed to their measurement. The work on the selection of the indicators effectuated by Istat and Cnel entailed a delicate balance between the need to measure the 12 well-being domains satisfactorily, the need to limit the number of indicators and the availability of data. The students' work was made easier by giving them the list of BES indicators and asking them to classify the indicators in the different dimensions. Since the proposed activity should not require prior knowledge of statistics and of statistical sources available in Italy from the students, the measurement process is simplified reducing it to the association between indicators and measured dimensions. This activity, however, requires that the students reflect on the meaning of the different indicators, understand what each indicator measures and that they identify which aspect of BES is measured. Students could perceive the partiality of the relationship between concept and indicator. On the one side a concept cannot be exhausted by a single indicator; and on the other an indicator may overlap only partially the concept for which it was chosen and depend for the rest on an another concept. So it is important to choose the indicators that maximize the part in common with the concept and minimize the extraneous part of the concept. Besides students highlighted the lack of coverage of certain domains by the available indicators and the need that Istat starts to produce data to monitor exhaustively the basic components of BES. Finally students reflected about the arbitrariness of the choice of indicators and the importance that the researcher arguments his choice.

By working through this process, the students experience the definition of a multidimensional concept by identifying the most simple concepts that describe it, the transition to measurable operational concepts, and finally the measurement by means of appropriate indicators.

The second phase of the project consists of a case study based on the regional BES data set (about 130 indicators in time series – of 8 to 10 years – for each Italian region – according to Nuts 2). Students are asked some research questions, which they should answer by exploratory analysis

of the data. The analysis can be conducted with a spreadsheet or using an application made available by Istat called Statistics Explorer (Bianchino et. al, 2014). The research questions are of the type:

- Are educational outcomes of women consistent with their professional achievement? What else influences the professional achievement?
- Do young people in northern and southern Italy have the same opportunities to find work in their regions of residence?
- Do men and women have similar life expectancies? And do they have similar life expectancies in good health? Is this associated to social class?

Moreover, students are expected to generate their own questions about equitable and sustainable development and to find possible answers.

The case study focuses on the development of a global view of data and data representation and promotes statistical reasoning about data analysis.

To answer the research questions, student have to analyse data, interpret the results, and communicate their conclusions. They can experience that this process is naturally recursive as long as the researcher does not achieve a satisfactory result. Moreover, they also understand that – at every step – the researcher has to make decisions that have a great impact on the final results. The exploratory analysis can be conducted through graphical representations and by calculating simple measures of centrality and dispersion. The graphical representation is particularly effective for the first interpretation of the data because students may inspect the structure of one or more statistical distributions, compare trends, and highlight the correlation between the variables, or identify outliers, cluster of data points and gaps. Many graphical representations are quite simple to realise with a spreadsheet or with Statistics Explorer and students may concentrate on choosing the most appropriate representation for each variable or pair of variables.

Starting from the graphical representations, the concept of correlation between variables and of linear correlation between variables can be easily introduced to students and some parsimonious models can be built.

Allowing students to explore the data is in line with current educational paradigms such as teaching and learning for understanding, inquiry-based learning and project-based learning (Ben-Zvi & Garfield, 2004).

Using the BES data set, students may first answer the research questions and then debate on further issues that arise during the exploratory data analysis about equity and sustainability of their lifestyles, even in a multidisciplinary perspective.

As the United Nations Economic Commission for Europe recommends in its guide to improve statistical literacy (Unece, 2014), experiential learning must be supplemented by the written and oral presentation of results because the process of writing about a subject reinforces and clarifies its understanding. In their projects students have to specify the goals, the details about the data set and in general about data sources, go through cycles of questions – data analysis – interpretation of results, and finally discuss the restrictions of the conclusions found.

A good way to verbalise the results of data analysis is through statistical story-telling. This approach focuses on developing a story around the analysis and its results, to catch the reader's attention by a headline or chart, and provides the story behind the numbers in an easily understandable way, in an interesting and entertaining fashion (Unece, 2009). The salient features of data analysed are communicated in a direct, concise and engaging way. Students used the software Statistics Explorer to write a story in this style enriched by dynamic graphs. Putting together data, charts, summary statistics and trying to give them a meaning highlights the potential of statistical reasoning, which students can apply in everyday life.

Using official statistics on well-being, students are stimulated to reflect about data quality, to generate their own questions about equitable and sustainable development, and to find possible answers. Using the BES data, students may define the overall condition of civil society and they may also learn that through official statistics it is possible to monitor and evaluate policies both at national and local level. Using electronic data processing and advanced graphic visualisation such as dynamic graphs, the young people are challenged in their field as digital natives as many of them are familiar with the tools that are used.

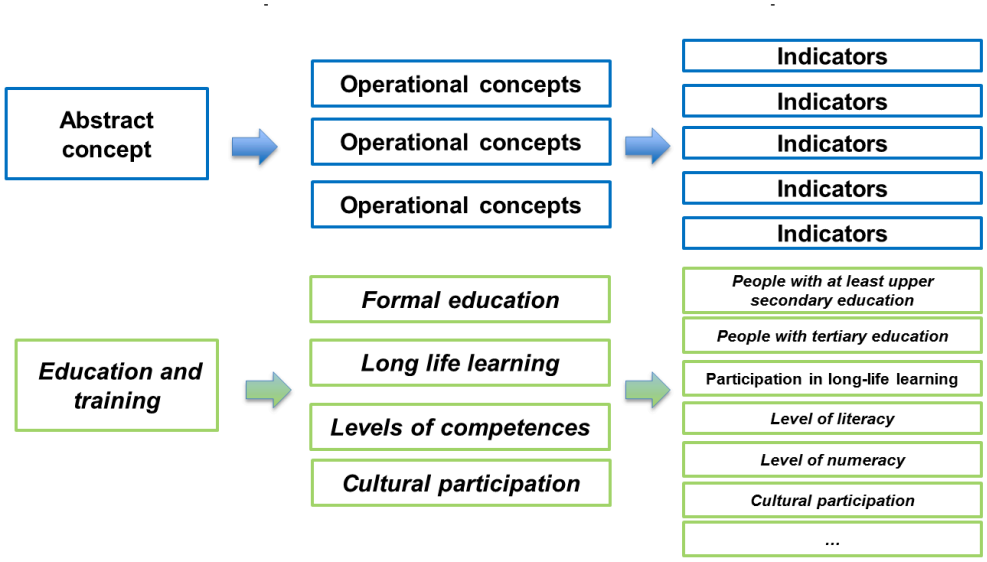

Figure 2. The operationalization of a concept

BENEFITS OF THIS PROJECT

- The students learn the BES project not in a boring lesson but in a participatory manner that allows them to internalize the concepts.
- The students experience the process leading from the idea and definition of a multidimensional concept until its measurement.
- The treatment of real data that describes economic or social phenomena known to the students, anchors the learning process to everyday life.
- The formulation of interpretative assumptions needed for data analysis encourages statistical reasoning and make students aware that this critical capability is useful in their everyday life and will be important in their later profession.
- Statistical analysis is approached in a multidisciplinary context, with questions concerning the daily lives of students, but also social issues that can stimulate their curiosity and their interest.
- Verbalizing the statistical analysis and writing the story students strengthen and clarify the understanding of the results and bring back the observation to the real world.
- This project may be conducted in any secondary school even where the students have limited mathematical and statistical skills, so any young person can get closer and become familiar with the statistics.
- In this project students encounter the ways the evidence based decision-making is performed.

REFERENCES

Alkire, S. (2002). *Dimensions of Human Development*, World Development, 30(2), pp. 181-205.

Ben-Zvi, D. & Garfield J. (2004). *The challenge of developing statistical literacy, reasoning and thinking*. Dordrecht: Kluwer academic publishers.

Bianchino, A., De Candia, G. De Francisci, S., Peci, M. & Pitrone, A. (2014). *Scuoladistatistica-Lab: un laboratorio virtuale per l'apprendimento della statistica*" (Scuoladistatistica-Lab; a virtual laboratory for learning statistics). In Didamatica. Informatica per la didattica. Nuovi processi e paradigmi per la didattica (pp. 851-855). Online: www.slideshare.net/PunkJanus/atti-didamatica-2014.

Giovannini, E. & Rondinella, T., (2012). *Measuring Equitable and Sustainable Wellbeing in Italy* in Quality of Life in Italy. Research and Reflections, Maggino F. and Nuvolati G. (eds.), Springer-Verlag.

Hall J, Giovannini E, Morrone A, Ranuzzi G., (2010) *A framework to measure the progress of societies*, OECD Statistics Working Papers (5): 26.

UNECE, (2009). *Making data meaningful. Part 1: a guide to write stories about numbers.* New York and Geneva: United Nations.

UNECE, (2014). *Making data meaningful. Part 4: How to improve statistical literacy: A guide for statistical organizations.* New York and Geneva: United Nations.

Wallman, K. K. (1993). *Enhancing Statistical Literacy: Enriching Our Society.* Journal of the American Statistical Association Vol. 88, No. 421 (Mar., 1993), pp. 1-8.