Italian NSI for the school. A new project to promote statistical literacy in Italian regions
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Published: 15 December 2016

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A key activity of Istat, Italian NSI, is that of promoting statistical literacy. In recent years this goal was further strengthened through the constitution of a network of around 80 experts of the territorial offices and the activation of proper synergies with the former School of Statistics and Socio-Economic Analysis (SAES). The most part of the network activities are devoted to promoting initiatives for the education system (teachers and students). One of the latest releases of the network is the *"community of sharing experiences between Istat operators and teachers"*, a place through which to discuss, share experiences and identify new approaches to the teaching of statistics across a process of cooperative intelligence. A particularly promising area of action is related to the use of virtual reality for the transfer of educational content. The Territorial Office for Apulia, maintaining and further developing the main goals of the network, acts synergistic actions of disseminations in many schools of the region. Tools adopted are mainly those of the educational packages. Methods of administration are quite innovative. There is a specific attention to find instruments of linkage between teachers in order to share educational technology and skills to develop students' abilities in the area of calculation, interpretation and graphical representation of data. A further instrument introduced to guide students towards critical thinking is that of laboratory. By means of laboratories students of secondary school are able to follow the entire process of data production, from microdata to methods of synthesis.

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1 Introduction

In developed societies the production and dissemination of data grows exponentially every day. To give a quantitative idea, in 2015 global internet population reached around 3.2 billion of people (https://www.gwava.com/blog/internet-data-created-daily), nearly 20% more than two years ago, a level equivalent to the word's population in 1960. Actually, the amount of data created on the internet each day is stinking: 500 million tweets, more than 4 million hours of content uploaded to YouTube, 4.3 billion Facebook messaged posted and 6 billion of Google searches. The number of "statistics" produced grows with similar proportions. The large amount of information available is surely a sign of progress for democracy, but it is necessary to be aware that the most of data sources are often uncertain and of very poor quality, so many of the so-called "statistics" are just numbers with little meaning. It takes much more than in the past the need to be able to critically think about concepts and arguments, to read, interpret and evaluate information. According to Linden (2002), this activates the process of finding micro and macro data at the study, question, and variable levels; the activity of understanding the 'data life cycle'; browsing websites for finding data; using metadata and codebooks to evaluate and use data. In a word, it needs to be statistically literate.

Statistical literacy (Wallman, 1993) should not be seen only in the meaning of *numeracy*, but should be considered, more in general, as the ability to provide a critical analysis of statistics in terms of both communicating results and (especially) using statistics for daily life. Statistical literacy is in effect the result of a complex hierarchical construct (Watson and Callingham, 2003). To win the challenge of promoting statistical literacy (Gal, 2002; Garfield and Ben-Zvi, 2008) it is necessary to activate systemic actions aimed at describing the central role of statistics for society. In this scenario of data deluge the only way to protect and boost the functions of official statistics is to put in place the most appropriate actions to promote statistical literacy to stakeholders (Beaudoin, 2014) and to the whole society.

The role of NSI's is this process is crucial. It is necessary to act a long-term cultural action of great depth. The most important international project (Ferligoj, 2015) is the International Statistical Literacy Project (ISPL), carried out by the International Association for Statistical Education (IASE), the education section of the International Statistical Institute (ISI). The main target groups are citizens, media, educational institutions (secondary school and upper secondary school-age students), universities, research institutions, decision-makers, libraries and national statistical agencies.

In Italy, Istat is member of IASE and has been pursuing the goal of disseminating statistical literacy for many years. Large-scale promoting initiatives were acted on the occasion of the two last census rounds: 'Census at school' in 2001 (Lombardo and Conti, 2003) and 'Let's play at census!' in 2011 (Da Valle and Valentini, 2013). More in general at the turn of the new millennium multiple events have been undertaken at central and at a local level (Istat, 2006; Peci and Sterzi, 2007). More recently (February, 2013)

actions of Istat along with this direction have been more and more strengthened by the constitution of the '*Territorial network of experts in promoting statistical literacy*', (NPSL) (Cortese and Valentini, 2013; Valentini and Cortese, 2014).

The network is composed by a staff of more than 80 people (working for the project for around 20% of their times) located in the various Territorial Offices of the institute. The main role of NPSL components is to design and implement actions, activities and instruments to support the development of statistical literacy in their different work districts. NPSL operates in line with the statistical agenda Stat2015 (Baldacci, 2012) whose main objectives are to standardize and modernize statistical processes. NPSL was finally able to give a *renewed* impulse to dissemination actions thanks to its ability to rationalize and systematize previous experiences, to develop innovations, to encourage the dissemination of good practices and, last but not least, to spread optimism.

Each component of the network has a dual role: to develop materials and projects for the entire net; to implement actions for the territory of competence. During 2014, the network has realized about 350 actions: half of whom (185) directed to the school system; 16% to universities; 5% to institutions of the Sistan (Italian network of official statistics); the remaining part to other actors (stakeholders, administrators, whole society). Initiatives were followed by around 20,000 subjects. At the end of each event participants compiled a feedback questionnaire concerning the initiative. Feedback was favorable: in the range between 1 and 5 the assessment of teachers, operators of the Official Statistical System and university students was 4.3; the agreement of students was 3.5.

Among the activities carried out by the various offices of Istat, the territorial office of Apulia has developed a specific expertise in two main areas: laboratories for the analysis of micro data; use of virtual environments. Analysis of microdata were conducted during the scholastic years 2013/2014 and 2014/2015 for teachers and students of two high schools[1]. Topics were related to: understanding of information content of enquiries; use of statistical software for reading of datasets and building tables and graphs; data analysis.

Virtual environments were adopted for their capability to capture the interest of children thanks to the use of scenes created for video games and for entertainment. The project was carried out jointly with Statland[2], a 3D virtual learning environment dedicated to statistics integrated as a 'virtual island' in Techland. Throw Statland it was possible to integrate teaching with innovative information technologies and to show statistics in a new charming way.

Present paper is structured as follows. The first part (§2) is dedicated to show the network activities in detail, in terms of both organization and methods of work. A focus is deserved to specific activities carried out in Apulia. Later (§3) the paper shows the main results of the promotion activities that took place on the various territories thanks to the new organizational scheme. Once again, special attention is devoted to

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[1]Scholastic year 2013/14: 4th class of the Industrial and Technical Institute 'Ettore Majorana' located in Brindisi; Scholastic year 2014/15: 2nd class of the High School 'Leonardo da Vinci', located in Bisceglie

[2]Statland was realized by teacher Michelina Occhioni (http://www.virtualscience.it)

the experiments performed in Apulia. Results emerged are encouraging: the last part of the work (§4) outlines the network's activities for the near future as well as some long term strategies.

2 Method

The goal of enhancing statistical literacy is broadly shared in international scientific community. Among the projects devoted to reaching this scope, the most popular and widespread is probably ISPL. Participant countries are about 80 among them Italy: they communicate one-each other through the website (http://iase-web.org/islp/), a virtual forum for the exchange of information between those seeking and those offering tools and projects of promotion. See Sanchez (2008) to analyze some of the successful statistical literacy programs of government statistical offices. Another worldwide project is StatLitSite, launched by an independent organization, whose main mission is to present the statistical literacy as an interdisciplinary activity, related to daily activities. The portal (www.Stat-lit.org) also offers a vast collection of tools (articles, videos, etc.) of interest.

Recently, United Nations Commission for Europe produced a guide (Unece, 2012) to improving statistical literacy of member states. A specific focus is on students, for the key role they will have in society. Other targets are represented by decision makers, opinion leaders and the whole society. Strategies are differentiated according the needs of the different groups.

In Italy, the approach of the territorial network for promoting statistical literacy is based on the Unece suggestions: segmentation of the target, establishing relationships with stakeholders, providing statistical training and seminars and so on.

NPSL components operate throughout the country with a complex organization able to guarantee a multifaceted approach.

2.1 organization of the territorial network

The territorial network for promoting statistical literacy was formally established in February 2013. The network is integrated in the Development and Coordination of Territorial Network and National Statistical System Directorate. A full synergy has been activated with the School of Statistics (SAES) (Peci, 2013; Istat, 2015), devoted to act promoting activities at a central level. The organizational structure (Figure 1) of the net is complex because the overall aim of disseminating statistical literacy has to be reached integrating different types of projects and objectives. Results are guaranteed thanks to a full synergy between actions of all territorial offices.

Activities are organized in working groups; the continuous coordination between the components of different territories within each group is achieved through the use of both web-conference tools (Valentini and Porciani, 2013) and a specific community, active on the platform of social network of Sistan.

More in detail, long-term strategic objectives of the network are the followings:

- *standardization of approaches and methods*: a census of all promotional materials produced by territorial offices in the last five years was made. More than 300 packages have been acquired and are now easily and freely accessible to all network operators. The most significant materials were standardized in terms of: a) content, given that instruments are congruent with scholastic programs (national indications for the study planning); b) language adopted, specific for each kind of school (from primary to upper secondary); c) format, with thematic folders organized as dossier. Before the release, materials were tested (in sample schools).

- *assessment of actions*: each field action is evaluated both internally and externally. Internal evaluation is subjective; it is based on the judgment of the Istat representative in terms of participation and in terms of ability to activate other actions. External evaluation is objective and is based on an assessment questionnaire administrated to participants of the various initiatives. Questionnaire is customized according to the type of participant (student, teacher, public servant and so on).

- *dissemination of good practices*: many initiatives on the territory are developed as prototypes by one or more territorial offices. Most interesting projects are exported to the entire network as new actions. This is for example the case of initiatives in streaming or the case of courses on specific topics.

- *release of learning tools*: the network produced and released on the institutional web-site[3] a set of learning materials for students of the three types of schools: primary schools (ages between 6 and 10); junior high schools (ages between 11 and 13); upper schools (ages between 14 and 18). Materials are periodically updated and renewed.

In order to maximize the organizational efficiency, a skill gap analysis was realized. The first step of the analysis was the identification of the proper needs for each working group. Then an assessment questionnaire was admired to components of NSPL in order to measure the gap between the skills and abilities needed to play the role expected and the skills and abilities claimed. Finally, training courses were planned in order to fill the gap.

Materials and methods introduced are adopted for on field activities by operators of the network. Actually, targets of dissemination are the followings:

- *scholars*: target includes children of three types of schools: primary schools; junior high schools and upper schools;

- *teachers*: these are the school teachers of various disciplines, and not only of mathematics. This group is particularly important for the central role among students;

- *university students*: this target is included for the key role that a part of those students will have in society in the next years;

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[3]http://www.istat.it/it/informazioni/per-studenti-e-docenti/under-21/pacchetti-didattici
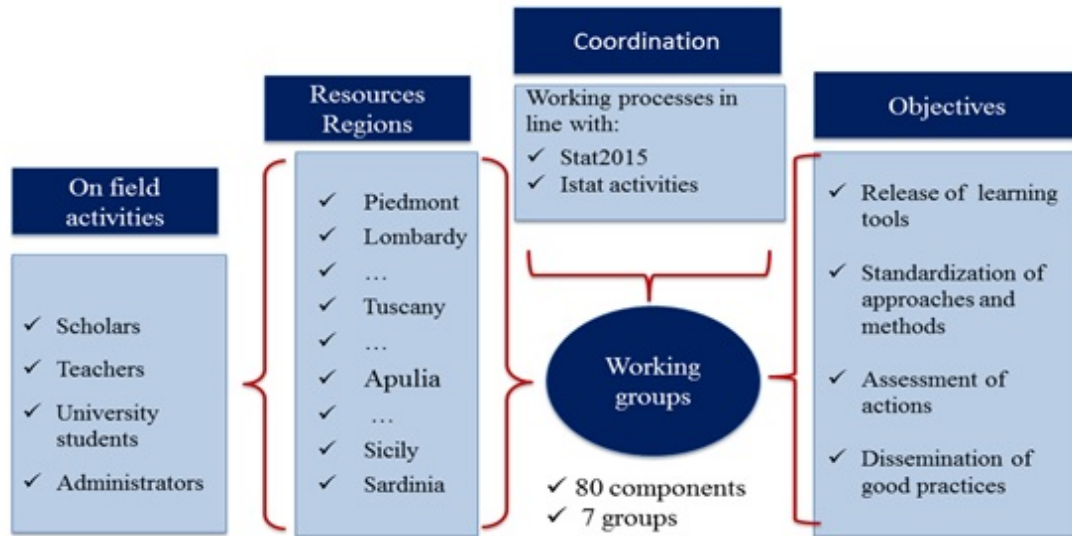
Figure 1: Organization of the network

- *administrators*: a new core of activity of the network is directed to public adminis-
  trators, in order to show the central role of statistics for stakeholders and to bring
  attention to the key role of Statistical Offices (local hub of Sistan).

Present paper is focused on students and teachers, with potentially more than 3 million
of unit in Italy (around 17% of total population if all components of student's households
are included). This type of approach presents several elements of innovation, in terms
of both target and method. With reference to the target, newness is represented by
teachers, disregarded in the past. Improvement of the method impacts instead on the
process, on materials and on modes of fruition.

2.2 Projects of Apulia

In order to maintain and develop the coordinative scheme of the network, the Apulia
Regional Office has promoted the use of a variety of educational packs in a large number
of local schools.

It has also set up a new line of activity designed to create, support and nurture a net-
work of teachers who are keen to share educational technology and skills aimed towards
developing student skills in areas such as the calculation, interpretation and graphic
representation of data. The new portal of Sistan, therefore, has set up a community
of teachers 'The sharing of experiences between Istat and teachers' in order to foster
dialogue, sharing of experiences and the identification of new approaches to the teaching
of statistics.

The community is organized into three sub-community independent one each other.
The first sub-community contains educational material produced by Istat and collects

feedbacks on the materials and tools available. The second is a kind of laboratory on the microdata and allows the exchange of experiences on the acquisition of practical skills, such as building a database and statistical analysis, using mainly open-source software. The third sub-community compares the different experiences of transferring of educational content through the use of virtual environments.

In order to help students in the use of critical analysis in the field of statistics, the Apulia Regional Office has also experienced an innovative approach in two secondary schools, starting with micro-data and then following the development of the entire process of producing statistical information. Every day data are produced and collected at an explosive rhythm and everyone leaves behind a 'data trail' simply by using the phone, participating in a social network or by purchasing online. It therefore becomes crucial to turn this indistinct mass of data into useful information. Statistics is the instrument platform privileged to orientate in the world of data, but not intended as specialized technical competence but as critical ability to read data. So, from the data and not from concepts, the goal was to teach students to use and manipulate the extensive information available to us every day.

In the school year 2013/2014 the Apulia Regional Office has also developed a project to promote statistical literacy in schools using virtual environments. Over the past decade, in fact, virtual worlds, born for video games and for entertainment, are also tested by schools in order to make it fun and motivating environment for learning science and mathematics.

Inside the virtual islands of Techland, 3D virtual learning environment dedicated to mathematics and science, it was realized Statland, a virtual island devoted to statistics. Using Statland it is possible to follow the paths free or structured explaining the steps and methods used to perform statistical surveys. It is also possible to interact with animated learning objects that illustrate the mathematical basis. Platform is accessed by an avatar in the world that creates and interacts with objects and other avatars. The mediation of the avatar allows a full immersion in the discipline and interaction with animated 3D objects makes tangible and viewable even abstract concepts like arithmetic and geometric.

The objectives are to promote the development of statistical literacy by teachers and students, to facilitate collaboration between educational institutions and official bodies of statistics, integrate teaching with innovative information technologies. This tool enables students to view content through the LIM with the mediation of the teacher, and realizes 'videolibri', that are video lessons by the technique of screen capture and, to the student, to navigate the island interacting remotely with other pupils / avatar.

3 Results

The new organization system and a renewed focus on promoting activities have multiplied dissemination initiatives and the production of materials. There is a strictly interconnection and a positive synergy between materials and initiatives: in most cases the cornerstone of an initiative is the use of packages and tools produced by the network;

in other cases packages are illustrated and disseminated on the occasion of events.

More in detail, to show the main realizations, it is useful to introduce the steps of the life cycle of a project. Steps are the followings: 1. the project is launched as an innovation in a certain region; 2. the first event is realized; 3. after a start-up period, the project is incorporated by the network; 4. events are multiplying on the basis of a system of viral spread in the region and in other territories. 5. initiatives follow a path of continuous quality improvement through the assessment system adopted. A specific care is devoted to all the initiatives, but components of the network pay specific attention to all the events aimed at the training and involvement of teachers, for their key role in society.

Activities of the network in Apulia are moving according to general lines of the network and produce similar results. Below the illustration of the effects of the two main projects: experiences with microdata and use of virtual realities.

3.1 Materials released and initiatives undertaken by the network

3.1.1 Teaching materials

One of the most important objectives of the network was the release of teaching materials both for schools and for university student. In this paper the focus is on materials for schools. Till now, packages released are 27: 10 for primary school; 8 for middle school and 9 for upper school. Table 1 shows the detailed list of topics covered. As indicated in Caporrella et al (2014), also taking into account previous experience in the field (Da Valle and Valentini, 2011), materials are organized in the form of dossiers. Materials are also translated in German thanks to the cooperation of ASTAT (statistical office of the autonomous province of Bolzano). Dossiers include: a) an interactive presentation in Power Point, able to introduce students to the topic; b) a set of exercises (in Excel), and their answers, structured to be administered through the PC, through the interactive whiteboard or on paper; c) a note to the teacher with technical insights on the subject. The packages for upper school are divided into 'tracks'.

Topics proposed are aligned with new National Indications for school curricula and with the reference framework adopted for surveys on students' learning, realized by INVALSI (Invalsi, 2014). Three new topics (on INVALSI tests, statistical indicators and statistical processes) have been realized and will be released on the Institutional website of Istat.

Before the release each package was tested in some schools according to a test-protocol. Tests includes the feedback of both teachers and students. For instance the three new topics were tested (in different versions for the various typologies of schools) by 41 teachers, 289 students of middle and upper schools and 528 students of primary school. Tests are based on a questionnaire with various items concerning the various aspects of the packages: effectiveness of communication; materials; balancing theory with practice; integration with the scholastic curricula. Each item is expressed on a Likert scale from 1 (totally disagree) to 10 (totally agree). The average score for teachers was 8.8. The average score for middle and upper school students was 7.9. The average score of students

of primary schools was 8.0. Test included the indication of any weaknesses. Criticisms, if any, are removed before the release.

3.1.2 On field activities

On field activities realized by the network are mainly linked one-each other through a specific project and are generally replicated in various territories of different regions. The most important projects activated for students are the followings:

- *statistical week:* for primary and secondary schools. Students approaches the themes of statistics in a playful and fun way through a sort of 'game of the goose'. The project requires an educational preparatory work done with teachers and pupils involved. The final game is the result of statistical concepts previously introduced. The number of participant was of about 300 (in 16 classes);

- *statistical open-day:* initiative conducted in some high schools as guidance for students of middle schools. Statistics is presented in the form of game ('Who wants to be a statistical?') and participants have to answer some questions on the basis of a dossier previously received. Participants were around 500;

- *welfare of teenagers:* a research project aimed at testing a system able to detect and 'measure' the subjective well-being of teenagers. The first phase of the project involved the administration of an online questionnaire to students of secondary schools and a questionnaire to their parents, submitted by students themselves. Test classes were 10;

- *stat.lis-statistics vocabulary of the sign language:* implementation of a pilot video-language vocabulary in Italian Sign Language (LIS). The project is part of the information contained in the Convention on the Rights of Persons with Disabilities UN, to which Italy has joined ratifying with a specific protocol. The pilot project was developed in collaboration with an institute of higher education and produced, as first result, two videos in sign language on some basic concepts of statistics related to indexes of position and variability;

- *micro-data experiences:* an innovative approach to data for students of upper schools. Statistical activities starts from the microdata files for public use Istat, using open-source software. Istat in Apulia is leader of this project. See Par 3.2 for details. Microdata are drawn from the Istat survey on routes concerning study and work of graduates ("Indagine Istat sui percorsi di studio e di lavoro dei diplomati");

- *virtual reality for statistics:* virtual environments for learning statistics. This experience was completely developed by Istat in Apulia. See below for details;

- *promotion performed by students themselves:* A group of students is identified as 'tutor' to disseminate statistical literacy toward younger students under the supervision of the territorial office of Istat. Tutors are university or high school

students. The potential multiplier effects of these initiatives are very promising in the light of the establishment of 'virtual enterprises' provided by the system of training introduced by so called 'Legge sulla buona scuola'.

The principal projects for teachers are instead the followings:

- *statistical training for teachers:* statistical courses for teachers of all school levels even often organized with the partnership of universities. Items treated are those of scholastic programs. The activities are carried out through a mixed methodology: in presence, streaming, through a specific community. In some cases courses are associated with experiences of surveys carried out with the help of students;

- *Invalsi courses:* in Italy, all students of the 2nd and 5th year of primary school, of the 3rd year of middle schools and of 2nd year of upper School must support the so called Invalsi tests, aimed at assessing their skills and knowledge in various areas of Mathematics and Italian. The project of Invalsi courses is deserved to teachers in order to help them to transfer student appropriate skills to correctly answer the 'data and forecasts' area of the Mathematics test. The project was launched with the cooperation of the Regional Directorate of Ministry of Education and till now around 300 teachers participated.

On field activities linked to one or more project for disseminating statistical literacy are continuously monitored through an on line system, whose flow-chart is illustrated in Figure 2. The first aspect was the monthly planning of the initiative. The second aspect was the monitoring of achievement throw the filling out of an on line questionnaire. After the event, materials have to be uploaded in a specific community.

Some of the figures concerning the monitoring system are the followings: more than 95% of events projected were realized, for a total of 484 events in the period between March 2013 and October 2015. More in detail: 149 (30.8%) in the last 10 months of 2013; 187 (38.6%) during 2014 and 148 (30.6%) in the first 10 months of 2015. The most part of events (14.5%) were realized in Campania, followed by Abruzzo (8.5%). The quota of Apulia was of 3.5%. Activities are differentiated one each other by various aspects but some similarities appear. Table 2 reports in greater detail some indicators. The most part of projects (more than 50%) are for schools: teachers and students. Within the various typologies, the most frequent are seminars (32.2%), followed by information meetings (23.1%) and by formation courses (17.6%). On average, the length of initiatives depends of the typology. Overall duration of an event was of around 4 hours and 12 minutes: longer (+20 minutes) for laboratory and shorter (- 56 minutes) for conferences and conventions (- 20 minutes). The number of participants was on average of 75 for each event, more elevated for conferences (+36) and reduced for Information meeting (-35) and laboratory (-32).

Half of events were realized by Istat in partnership with other institutions. In most cases partners are offices of Sistan (36%) and Universities (32%). Interaction with the word of scholastic directions is instead scarce (10%).

The last component of the monitoring system is that of feedback, both internal (in terms of agreement of the organizer) and external (customer satisfaction). Internal
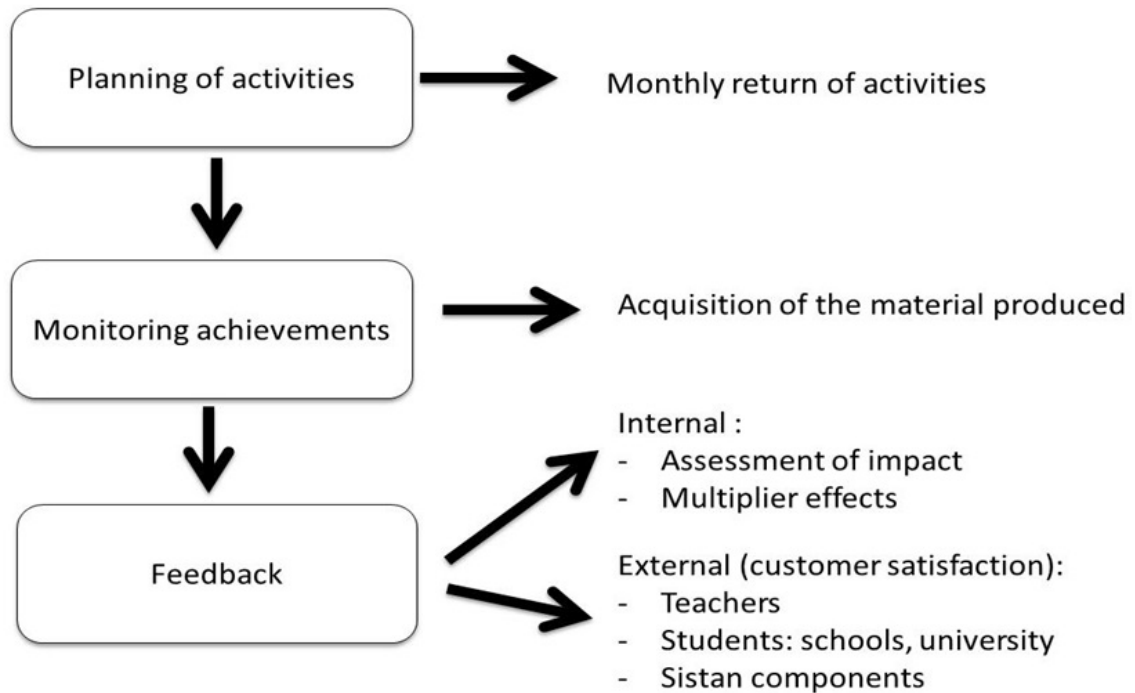
Figure 2: Scheme of the monitoring system

monitoring is based on a questionnaire submitted to the coordinator of the initiative. The main items are linked to organizational aspects (timing of initiatives; criticisms) and to the evaluation of the so called 'multiplier effect' (δ), that is the number of events generated starting from a preceding event. In order to calculate δ the questionnaire includes some items on the linkage between the various events. For a certain period δ is equal to the ratio between the number of links and the number of primal events. On average $\delta=0.65$. This means that 100 primal events generate 65 new events. The highest pick is for laboratory ($\delta=0.79$), the lower for conference/convention ($\delta=0.11$).

A subgroup of events (20.1%) was subjected to a deeper analysis. Participants received a customer satisfaction questionnaire in order to assess the whole initiative and the various aspects of it (fulfil expectations; treatment of arguments; interest in deepening the topics and so on). The total number of questionnaire sent was of 1,736: 35.8% were sent to students, 30.6% to university students, 30.2% to teachers and 3.3% to other subjects. The most common typology of event was Information meeting (38.1%), followed by Conference/Convention (23.2%). Answer rate to questionnaires was 66.2%.

Items are expressed on a Likert scale from 1 (totally disagree) to 10 (totally agree). On average, the agreement of initiatives was 8.6 for teachers and components of Sistan, 8.4 for university students and 7.0 for students. Criticisms of students are mainly linked to the ignorance of the argument and to differences between expectation and training

received. This aspect requires some attention, in fact it is not related to efficiency of activities, or at least it is not directly linked to this. The scope of initiatives effectively is to promote statistical literacy and is not teaching statistics: probably this is not very clear to students.

3.2 Results of Apulia

The two main project of Apulia are those concerning micro-data experiences and virtual reality for statistics.

The experimental project with microdata was realized with students of two high schools. The first step was to make students able to understand what are the microdata and where to find them and the role of metadata, i.e. information of a qualitative and / or quantitative terms relating to methods of production of micro-data themselves.

The students of the first school worked on the microdata files for public use Istat survey on routes of study and work of graduates, freely downloadable from Istat, in full respect of the rules for the protection of confidentiality (http://www.istat.it/it/prodotti/microdati). This is a sample survey every three years, made with CATI (Computer Assisted Telephone Interviewing) and conduct of a single lever of students surveyed about four years after graduation (26.603 interviews). Through the survey are detected various other information: the results of schooling, the opinions on the school experience, further study, the inclusion in the labor market and job characteristics found. The students learned about the methodology of the survey selected, the survey questionnaire and to read the record layout (Figure 3).

Figure 3: Questionnaire (left) and record layout (right) of 'Indagine Istat sui percorsi di studio e di lavoro dei diplomati'

From the list of all the available statistical packages with free license on the network, for reading the file and its import was chosen software PSPP. It is a free software and open source platform that runs on any computer and with different operating systems

(GNU / Linux, Mac OS X, FreeBSD, Windows) and is aimed at particular statistics, sociologists and students who require data analysis. With PSPP it is possible to perform descriptive statistics, T-tests, linear regression and non-parametric tests. The motor is designed to perform the analysis as quickly as possible, regardless of the size of the input data. You can use PSPP with its graphical interface or through traditional command-line syntax. Through software PSPP, students have learned how to import the file, read the data set and analyze the data (Figure 4 and Table 3). At the end of the project the students have made a report of the survey results and a video explaining the experiment carried out.
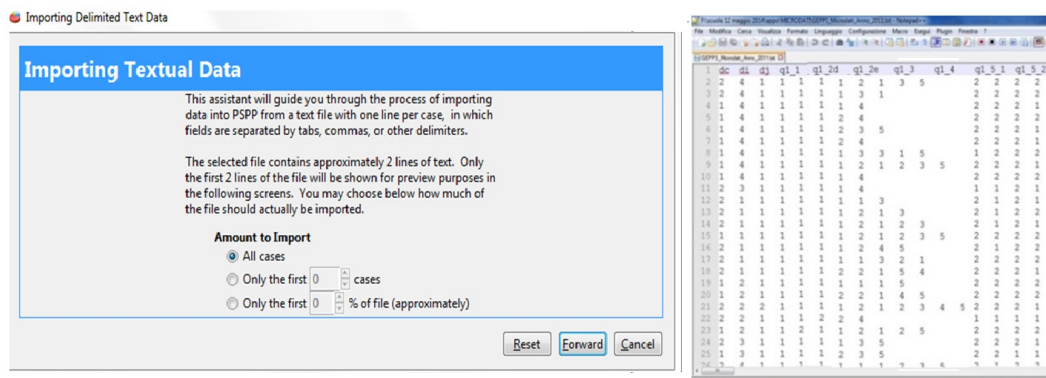

Figure 4: Adoption of PSPP: Importing files (left) and reading of the data set (right)

The project has been replicated in the school year 2014/2015 with a class of another school analyzing the data of the PISA (Programme for International Student Assessment) promoted by the Organization for Cooperation and Development (OECD) every three years to ensure the skills of fifteen-schooled. The reference population is made up of the fifteen-schooled since the age above, in most OECD countries, the term of compulsory education. Attention is focused on the extent to which students are able to use the skills acquired during their school years to address and solve problems and tasks encountered in everyday life and to continue learning in the future (lifelong learning). The survey, to collect information about context variables, using three questionnaires, respectively addressed to students, school administrators and parents, in order to interpret the data of the cognitive tests in relation to the school context, family and socio-cultural circumstances of students.

The analysis was conducted on data from Apulia collected from the questionnaire for students (Figure 5 shows the questionnaire and an example of frequency table with PSPP).

The second project realized is that of exploring virtual environments for learning statistics. Specifically has been given methodological-statistical support for the implementation of Statland, an 'island' of statistics made in OpenSim virtual world. The island was useful to create a 3D statistical learning.

Statland is divided into four sections that reflect the main stages of the statistical
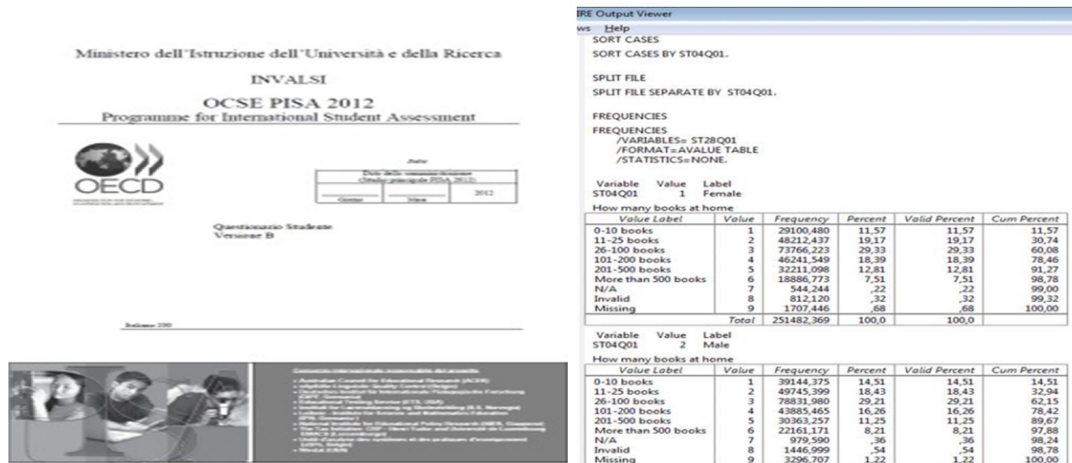
Figure 5: Survey Ocse-Pisa 2012: Questionnaire (left) and an example of frequency table with PSPP (right)

survey: design, collection, processing and representation. The interactive 3D objects are activated at a click of the mouse, the information is displayed in chat as notes or as retractable panels.

The avatar acts as a kind of virtual assistant interact with objects without compromising the function of mediator of the teaching faculty. Each student has access to the virtual world through their avatars, build objects or follow the personalized learning paths. The ability to communicate with other avatars in chat or voice also promotes collaboration at a distance. Figure 6 shows the virtual worlds of Statland.

4 Directions for future work

In recent years Istat, Italian NSI, is becoming increasingly aware that promotion of statistical literacy has to be referred not only to actions of numeracy, but also to a wider concept. In particular it is crucial to spread the idea that statistic is a useful tool for everyday life, a worthwhile help to make decisions for personal or professional use. A boost of effort in promoting activities becomes more and more urgent at the light of the growing data deluge, mainly caused by technological evolution. The recent constitution of the 'Territorial network of experts in promoting statistical literacy' moves towards this direction.

Among the elements that constitute the basis of the network, the most important is probably the full interaction and integration between centralized approaches and local initiatives. Each regional tie of the net is able to receive requests from the Italian school system and to answer taking into account both the local expertise and methods and materials produced by the all network. Effectively the logic underlying is that effects of dissemination are more widespread taking advantage of the many local experiences
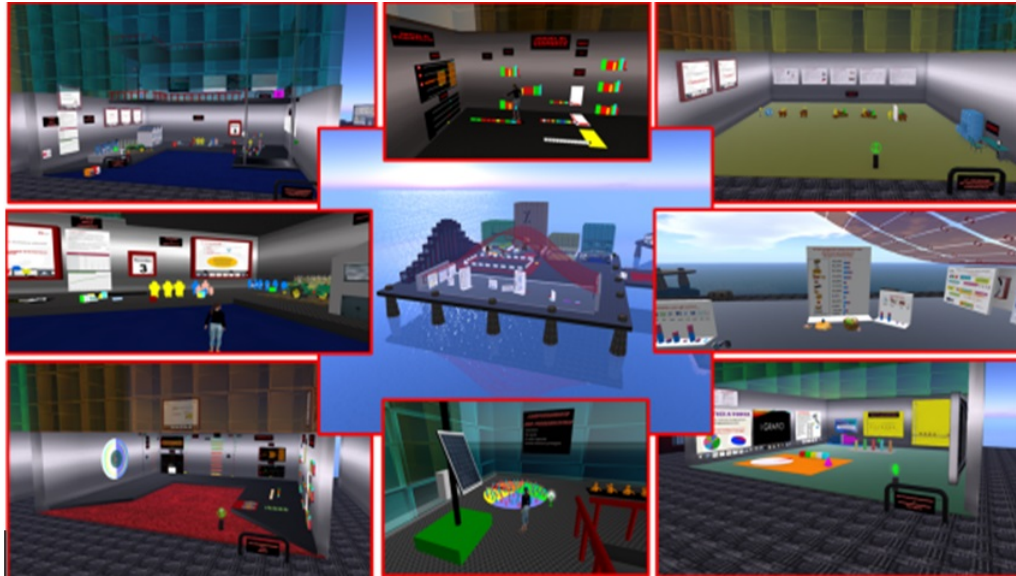
Figure 6: Virtual worlds of Statland

successfully tested in different geographical contexts. Each new and useful act is incorporated in the network, standardized and released in order to follow a viral diffusion process.

The strengths of this system are represented by the interaction with schools. The focus is on both students and teachers. For children and teenagers the key to the success of promoting initiatives is to replicate experiences of Apulia in terms of treatment of micro-data and use of virtual world in education. With specific concern to micro-data, all the practices directed towards the creation of surveys and analyses of data are the welcome and should be encouraged and supported. A greater experience in the use of virtual realities for statistics allows to catch the interest of students in statistical disciplines. In the meanwhile this permits to share experiences and collaboration at a distance with other students/avatars.

A full interaction between Istat and teachers guarantees long-term results and multiplicative effects in actions devoted at promoting statistical literacy in classes. The most important actions are those of education/training not only on teaching of statistical theory, but especially in the use of statistics as an instrument to better read and interpreter reality. For this goal training courses should also include statistical sources and the use and treatment of micro-data. A further support to the community of teacher should be another vehicle to recognize their role, to share experiences with others, and to experiment new approaches with statistics.

Another keystone for the increasing of disseminating activities is the strengthening of promoting activities for the university system according to a double way: the release of teaching materials, whose items are defined on the basis of a recent recognition of training needs, and the planning of seminars on official statistics.

At present, the concrete realization of initiatives depends on bilateral agreements between territorial offices of Istat and individual schools or university departments. The idea for the next future is the signature of memorandum of understanding between Istat and the Italian Ministry of Education. From the memorandum should descend a homogeneous approach to all schools, universities and teachers. The standardization and the generalization of the approach will allow strong economies of scale.

Finally, another challenge of Italian NSI is the new theme of alternation between school and work and the eventual chance to make use of "simulated enterprises" in training in order to allow students to train younger pupils. The revision of legislative and regulatory limits should actualize these new opportunities.

Table 1: Teaching materials for schools:topics covered and number of packages

Type of school	Topics covered
Primary school	ABC of statistics:
	- *One-way frequency tables*
	- *Two-ways frequency tables*
	- *Pictogram*
	- *Bar charts*
	- *Mode*
	- *Mean*
	- *Exercises*
	First steps to discover statistics:
	- *Let's know Istat activities*
	- *The work of statistician*
	Let's play statistics
Middle school	Let's read reality through statistics:
	- *Base statistics*
	- *Figures*
	- *Tables*
	- *Variability*
	Travel to discover statistics:
	- *History of statistics*
	- *Istat activities*
	- *Statistical enquiries*
	The probability
Upper school	Introductory course to the official statistics:
	- *Istat activities*
	- *Statistical enquiries*
	- *Data diffusion*
	Course on statistics and the labor market
	Course on the representation of data:
	- *Tables*
	- *Figures*
	- *Age pyramids*
	Course on the questionnaire:
	- *Goals of the questionnaire*
	- *Administering methods*

Table 2: Summary report of the events realized by the network. Years 2013-2015

Recipients		Type of event		Year	
Category	%	Category	%	Category	%
Students	3.3	Conference	3.3	2013	30.8
Teachers	6.5	Convention	7.8	2014	38.6
Teachers and students	5.9	Formation	17.6	2015	30.6
Primary school	11.4	Information meeting	23.1	Total	100.0
Middle school	3.6	Laboratory	14.0		
Upper school	27.0	Seminar	32.2		
University students	19.9	Other	2.0		
Component of Sistan	10.7	Total	100.0		
Mixed	4.9				
General public	6.8				
Total	100.0				

Table 3: An example of table with PSPP

High school certificate:	Value	Frequency	%	Valid %	Cum %
Vocational training	1	1,681	20.05	20.05	20.05
Technical specialization	2	2,326	27.74	27.74	47.79
Classical degree	3	2,043	24.37	24.37	72.16
Science degree	4	1,366	16.29	16.29	88.45
Language specialization	5	968	11.55	11.55	100.00

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