

Statistics and Probability in the *Mathematics for Citizens Italian School Curriculum* ⁽¹⁾

*Statistica e Probabilità
nel Curriculum Scolastico de “La Matematica per il Cittadino”*

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Riassunto: La riforma del sistema scolastico dalla scuola materna all’università, un nuovo punto di vista psicopedagogico che ha spostato l’accento dalle conoscenze alle competenze, l’idea de “La Matematica per il cittadino” hanno contribuito alla proposta di un nuovo curricolo di matematica che ingloba la statistica e la probabilità, dando loro maggior risalto e migliore ruolo. La SIS ha collaborato con l’UMI nel predisporre la proposta. Questo lavoro intende dare sinteticamente conto di essa e del suo accoglimento nei curricoli elaborati dal MIUR al dicembre 2003.

Keywords: Mathematics for Citizens, Competence, School Curriculum Research

1. Introduction

As is the case in many parts of the world also in Italy statistics and probability are taught in the school as part of the mathematical curriculum. The strong pressure developed by the Italian statisticians via the Italian Statistical Society (SIS) since 1970 (Istituto di Statistica e Ricerca sociale “C. Gini”, SIS; 1971) resulted in the introduction in 1979 of contents of “Mathematics of certain events and mathematics of probable events” in middle school (11-14) and of elements of “Probability, statistics and computer science” in elementary school (6-11) in 1985. For what concerns the upper secondary school, the situation is still confused with different kinds of programs, where statistics and probability are present in different ways. In spite of the introduction in the curricula, statistics and probability still are the Cinderella among the teaching themes of mathematics, largely due to the teachers’ lack of training on the subjects. However, as the way in which the international mathematicians community views at mathematics is changing, paying more attention to the society needs, the way in which statistics and probability are perceived in curricula has to change too. This seems to emerge in this moment of deep transformation in Italian school system and curricula when a new overall system is going to be designed and new curricula are proposed by the Italian Ministry of Instruction, University and Research (MIUR).

Stressing the mathematical reform required by the massification of education and the role of globalisation (Ottaviani, 2002), this paper will put in evidence the influence of new teaching learning approaches and of curriculum research on statistics and probability contents at the school level.

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2. The reform and the proposed curricula

The official situation of the school system in Italy, at December 2003, is still in a transition period. School curricula exist designed in the past by a centralised system and in different periods. These curricula and the way they are implemented in school are more keen towards content topics than towards students' learning process. All of this co-exists with the autonomy of schools (DPR 275, 8 marzo 1999) by which each school has the power to organise year by year 20% of the curriculum according to the socio economic and cultural needs of its students. To line up the Italian system with the ones of the other EU countries, an Act was signed in Italy in March 2003 (Legge 53, 2003) which designed a complete school system from children garden to university. Two cycles are foreseen. The first one of 8 years comprises primary school (5 years) and lower secondary school (3 years), the second has two branches: lyceum (5 years) and education and professional training (maximum 4 years). The main points of this Act are the continuity in learning process from the childhood to the youth, the co-ordination of the curriculum of the two cycles, the possibility of changing from lyceum system to professional training system and vice-versa through a certification of competences.

"Competence" is the key word of the transformation process. This word is used in different contexts: as a mix of knowledge and skills that is possible to use in professional life and that it is possible to certify in the professional training system; as a result of the learning process that need to be assessed at the end of each school period or at the end of each cycle; as a personal quality that it is possible to develop thanks to general or specific knowledge and skills, in coherence with personal attitudes and choices, and that is adequate to participate in social life and workplace, both at local, national and European level. The first meaning is more linked to particular professional situations, the second is connected to the assessment moment. According to the third meaning, "competence" is a long term goal that students must achieve. "The competences must be possessed by the students in a way not linked to the space and the time in which they were reached, that means in contexts different from those in which they have been learnt and in times different from the school one that is in citizen's life" (Arzarello, 2002, p.95). The shift from content topics to competence has many consequences from the pedagogical point of view both for teachers and students, and implies a new teaching/learning style relying particularly on problem-posing and problem-solving didactic methods (Roletto Perrini 2000).

For what concerns statistics, however, the new reform is putting forward some particular challenges due to the new idea of mathematics that has developed within the international mathematicians community. Particularly in the last decade of 20th century, a movement has grown founded on the idea that "our civilisation has become increasingly mathematical" (CIEAEM-2002) and that "mathematical education can no longer be restricted to an elite education but has to be conceptualised as a mathematical literacy education for all". Obviously all of this has some consequences on curriculum, on classroom practice, on methods of teaching learning mathematics. In particular, in the introduction to its 53rd Conference the International Commission for the Study and Improvement of Mathematics Education (CIEAEM) recognised that "it is possible to interest and engage a maximum number of children and adults by an education which starts from the phenomena and processes of their daily life that promotes reflection and collaboration as a modus of teaching and learning" (CIEAEM 2002, p. 22). It is in this sense and for this purpose that also statistics has a new important role in school

curriculum, particularly if Gini's definition is accepted according which: Statistics is a discipline suitable to quantitative investigation of mass or collective phenomena, that is those phenomena the measurements of which require a collection of observations (Gini, 1962). By this definition and with reference to daily life phenomena - as for example social, economic, demographic, health, environmental phenomena -, functional statistical competences include the ability to pose and solve correctly problems concerning: the aim of investigation, the definition of the phenomenon to be observed, the way and tools to carry on observation, the collection of data, the organisation of the collected data in order to communicate sets of quantitative information, the way to handle data also with technology, conclusions drawn from the investigation process, comparisons among the results of the investigation process and the *a priori* aim of the investigation. If sample data are collected, the possibility to get conclusions concerning population may be done only at a certain level of probability, thus implying the utilisation of probability. In this context arithmetic mean, standard deviation, frequencies, and so on are much more than formulae and numbers, they are concepts and measure of concepts and probability is more than a matter of chance games.

In July 2000 the President of the Unione Matematica Italiana (UMI), prof. C. Sbordone, appointed a Committee to study and propose a new mathematical curriculum for school, adequate to the needs of 21st century society. M. G. Ottaviani, as representative of the SIS in the 1999 MPI UMI SIS agreement, was invited to take part into the UMI Committee. The Committee put forward the proposal of "The Mathematics for Citizens" and built on a curriculum from primary to upper secondary school. This curriculum is coherent and shows continuity, being based on competence concept and on some learning nuclei the content of which change progressively according to the teaching learning needs of the students. The nuclei put forward by the UMI Committee are of two kinds. The first ones are content nuclei, and the second are transversal in relation to the previous ones. For primary and lower secondary school the content nuclei are: *numbers, space and shapes, relations, data and previsions*; the transversal nuclei are: *taking measurements, reasoning methodically and conjecturing, solving and posing problems*. For the first four years of upper secondary school the content nuclei are: *numbers and algorithms, space and shapes, relations and functions, data and previsions*; the transversal nuclei are: *taking measures, reasoning methodically conjecturing and proving, solving and posing problems*. This makes evident that the UMI Committee has proposed statistics and probability as one of the content nuclei, thus giving the subjects a new evidence, if compared with the existing curricula. It is also evident to statisticians that each of the transversal nuclei may be interpreted as a particular aspect of statistical thinking. In the reform project the stress is not in notions, contents and simple formal exercises, but in viewing mathematics as a tool for interpreting the real world and for constructing concepts and models.

As mathematics school teachers need to be trained in this view of mathematics, in order to present didactical proposals suitable with "The Mathematics for Citizens" idea, a two weeks Seminar took place in 2001 that produced didactical units and assessment tests for primary and lower secondary school (MIUR, UMI, SIS, 2003). In 2003 a corresponding Seminar took place for upper secondary school. In the first seminar 8 units concerning "Data and Previsions" were produced by a team formed by primary and lower secondary mathematics teachers coordinated by M. G. Ottaviani with the help of M. P. Perelli. In the 2003 Seminar the presence of some teachers of mathematics with a *laurea* in statistics, made the activity of the "Data and previsions" team very rich. In

fact 12 didactical units were produced under the coordination of M. G. Ottaviani with the help of S. Rigatti Luchini and G. Anichini. The materials produced by the two teams could also benefit from the statistics education research and activities carried on by the CIRDIS in the occasion of the 1998 co-funded National Research Project (Brunelli and others, 2000; Rigatti and others, 2000; Milito, Marsala 2002).

With reference to the primary and lower secondary school, the reform project proposed by the UMI with the contribution of the SIS has been partly accepted by the MIUR, as it can be seen in the website www.istruzione.it/mpi/progettoscuola/index.shtml. The nucleon “Data and previsions” is in evidence along with well known mathematics chapters and the suggestion to develop gradually statistical concepts before probability ones has been accepted.

3. Conclusion

The Italian school system appears to be at the beginning of important transformations. Statistics and probability are needed by the citizens in 21st century. In fact statistical literacy is extensively required to competently participate in society and to acquire competences demanded in daily life and at the workplace. Statisticians have to cooperate to train teachers to teach properly statistics and probability at school.

References

- Arzarelo F., Robutti O., Paola D. (2002) Reform project for mathematics in compulsory school in Italy, in Bazzini L. Whybrow C. (Eds.) *CIEAEM 53 Proceedings*.
- Bazzini L. Whybrow C. (2002) Introduction to the theme and the subthemes of CIEAEM 53, in Bazzini L. Whybrow C. (Eds.) *CIEAEM 53 Proceedings*.
- Brunelli L., Galmacci G., Gattuso L., Pannone M.A. (2000) Un’indagine in classe per apprendere la statistica, *INDUZIONI*, 21.
- Gini C. (1962) *La logica della statistica*, Torino, Boringhieri.
- Istituto di Statistica e Ricerca Sociale “C. Gini”, Società Italiana di Statistica (1971) *Atti della Tavola Rotonda su “L’insegnamento della Statistica”*, Frascati 4-6 giugno ‘70.
- Milito A. M., Marsala M. R. (Eds.) (2002) Insegnare e apprendere la statistica a scuola, in *Quaderni di ricerca*, N. 1, Collana di studi del Dipartimento di Metodi Quantitativi per le Scienze Umane, Palermo.
- MIUR, UMI, SIS (2003) *Matematica 2001*, Attività didattiche e prove di verifica per un nuovo curriculum di Matematica. Scuola Primaria e Scuola Secondaria di primo grado.
- Ottaviani M. G. (2002) Le competenze di base: la matematica per il cittadino e la statistica a scuola, in Gallo E. ed altri (Eds.) *Unione Subalpina Mathesis, Seminari 2001-2002*.
- Rigatti S., Perelli M. P., Moncecchi G., Giambalvo O. (2000) Teaching statistics at primary and secondary school: an Italian research, in *Mathematics for living, The mathematics education into the 21st century project, Proceedings of the International Conference*, Amman, website: math.unipa.it/~grim/21project.htm
- Roletto E., Perrini P., (2000) Dalla scuola delle conoscenze alla scuola delle competenze, *Università e scuola*, anno V, N2/R.