

Not out of the blue: Historical roots of mathematics education in Italy

Fulvia Furinghetti

Dipartimento di Matematica dell'Università di Genova, Italy

Abstract. In this note I outline some elements of the history of mathematics education in Italy. Initially the chief characters were mathematicians who played a role in designing curricula and in editing textbooks. The development of the Italian community of mathematics educators towards the present day trend in research was fostered by participation in international activities after the Second World War. I also identify some elements of continuity with the past to stress the influence of some mathematicians in the development of present research.

Key words: history of mathematical instruction; Italy; research in mathematics education; mathematicians

1. The Past

Though the development of mathematics education as a discipline is affected by many factors I deem that the national policy of the system of instruction plays a major role. In turn this policy is strictly linked to the history of the country and to the academic world (in the case of mathematics the world of mathematical research.) As an example I briefly outline the events that preceded the birth of the Italian community of mathematics education research to catch a glimpse of links between the present situation and the past.

Italy became a unified country in 1861, before which it was composed of little states which had different systems of instruction or no system at all. To create a national system was one of the main concerns of the new government. It is remarkable that the concern about public instruction was already present before the unification, as evidenced by the proceedings of the annual meetings of scientists held from 1839 to 1847 in the future Italian territory. These scientists called themselves “Italian” before Italy existed as a political entity and planned the survey of the situation of the instruction in the Italian territory. It is said that the motto chosen for the proceedings of their meeting in 1846 was “*The educator and not the weapon will be in the future the arbiter of world's destiny*” and that this sentence was ink-cancelled (deleted) by order of the governor in almost all the already printed copies. Strong ideals were present in the scientific community: in particular, some important mathematicians participated personally in the independence wars and, when the process of unification was achieved, were involved in political activities (also as members of the parliament) concerning instruction. The evolution of the political situation in the following century changed the initial ideal position. The motto now proposed to school children in the 1930s (Fascist period) was “*Book and musket*”.

In the pioneering period after the unification the Italian community the relation of mathematics school teachers with professional mathematicians was sometimes difficult, as evidenced by the well known episode of the controversy around the teaching of elementary geometry. This episode parallels an analogous episode which happened in England and shows how similar situations may lead to different outputs in different countries. These are the facts. In Italy before the unification there was no tradition in mathematics education and textbooks were mainly imported from abroad. The first significant act of the new born nation was to publish an Italian mathematics textbook for secondary school. This happened in 1868 and the book was the edition of Euclid's *Elements* edited by two outstanding mathematicians (Enrico Betti and Francesco Brioschi). The Ministry of Education proposed it as a textbook to be adopted in Italian schools. The content was good from the mathematical point of view, but not suitable for secondary students. Teachers and mathematicians with some feeling of what mathematics education *should be* expressed a strong disappointment against the use of this book as a school text. A hot controversy was hosted in one of the two journals of mathematical research existing in Italy in those times (*Giornale di Matematiche*) from 1868 to 1871, see (Furinghetti and Somaglia, 2005). In one side of the duel there were the two editors of the *Elements* and Luigi Cremona, an important mathematician author of the official national programs for mathematics, in the other side there was a second rank mathematician who was caring for the pedagogical point of view and of school teachers' opinions. At those times the ordinary teachers had no voices, since professional journals did not exist, nor associations of mathematics teachers.

In England for many years the admission examinations to Cambridge, London and Oxford universities were based on rote exercises of Euclidean geometry. Many people were complaining about that, among them outstanding mathematicians such as Augustus De Morgan and James Sylvester. Books based on new syllabi were produced from 1868 onwards. In 1871 the A.I.G.T. (*Association for the Improvement of Geometrical Teaching*) was founded; it was the mother of the *Mathematical Association* founded in 1894. John Perry's address on 'The teaching of mathematics' delivered to the new 'Education' section of the British Association (1901) opened new perspectives to this problem: the educators were pushed to hear the voices of those students who would not become mathematicians and needed of a kind of mathematical education close to the requirements of the changing society. Perry's ideas were clearly expressed in the article 'The teaching of mathematics' (*Nature*, 1900, 317-320), see Howson (1982, pp. 147-148):

The young applier of physics, the engineer, needs a teaching of mathematics which will make his mathematical knowledge part of his mental machinery, which he shall use [...] readily and certainly [...]

[This] method is one which may be adopted in every school in the country, and adopted even with the one or two boys in a thousand who are likely to become able mathematicians.

In Italy things evolved in a different way. The academic power of mathematicians choked the timid attempts of rebellion to the use of the *Elements*. A sentence in the mathematics

programs issued after Italian unification epitomises the official attitude towards mathematics in school: “mathematics is a gymnastic of the mind.” This view was not unanimously accepted (especially by school teachers) and ironic references to this expression are present in papers appeared in the following years.

Many factors affected the different evolution in the two countries. Not only authors such as Herbart influenced the view of certain mathematics educators in England, but also the different level of industrialisation which called for a different role of education in society. This latter fact is evidenced by Godfrey’s passage as reported in (Howson, 1982, p. 158):

In England we have a ruling class whose interests are sporting, athletic and literary. They do not know, or if they know do not realise, that this western civilisation on which they are parasitic is based on applied mathematics. This defect will lead to difficulties, it is curable and the place for curing it is school.

A relevant factor in the different developments was mathematicians’ attitude about rigour. In Italy at the beginning of the twentieth century the concept of rigour was shifted from the Euclidean rigour to Hilbert’s and Peano’s rigour, but still remained the main concern of university professors when discussing mathematics teaching in school. This strong concern is epitomised by the important report on the various types of rigour in textbooks at the first big international meeting of I.C.M.I. in Milan (see Castelnuovo, 1911).

In the meanwhile teachers were growing up professionally. In 1874 the first Italian journal devoted to mathematics teaching was founded. After its death a journal was founded, which was the cradle of the Italian association of mathematics teachers born in 1895 (*Mathesis*). These journals were concerned with discussing details of mathematical subjects taught in school rather than on pedagogical issues. In principle the association of mathematics teachers should have been the right place to discuss educational issues, but this did not happen. Most energies were devoted to decide if university professors could be admitted as members. The association had various deaths and resurrections until it acquired a rather stable status in 1921 under the chair of Federigo Enriques, one of the greatest Italian mathematicians of the twentieth century. He was a researcher in algebraic geometry, and also author of textbooks and books for teachers translated into foreign languages. The first half of twentieth century was dominated by this relevant personage, who had to face events important for the Italian system of instruction, such as the reform promoted by the philosopher Giovanni Gentile. Unfortunately, in accordance with the idealistic philosophical theory of Gentile, scientific culture (including mathematics) was relegated to a second rank position. Other Italian mathematicians were contributing to the discussion on mathematics teaching and had contacts with the international milieu of I.C.M.I.. Besides Enriques, Guido Castelnuovo and Gino Loria were among the nine persons awarded by I.C.M.I. with the special acknowledgement for their work in the field of mathematics instruction at the world Congress of mathematicians in Oslo (1936).

We see that, as it happened in the pioneering period of the nineteenth century, the chief characters in mathematics education of the first half of twentieth century were mainly university mathematicians. In summarising their attitudes towards mathematics teaching we

may say that Enriques and Loria were interested in the dynamic of mathematics (its history, the psychology of the great mathematicians, the relationship of mathematics with painting, music,...). As a historian Loria was a pioneer in facing the problem of the use of history in mathematics teaching, especially in teacher education. Castelnuovo stressed the importance of modelling and application of mathematics; already at the beginning of the twentieth century he proposed the introduction of probability in mathematical programs. A singular position was that of Giuseppe Peano, who tried to apply directly the object of his research (logic) to school practice. According to him the language of logic, which is clear and not ambiguous, should make mathematical knowledge accessible to all students. Peano's project was utopian, but his enthusiasm and good willingness attracted secondary teachers who collaborated with him. His environment constitutes an early example of a mixed group of university professors and school teachers working on didactic problems.

2. The Present

The international panorama has changed since the period I have considered before. In the period after the second world war, we saw international efforts of important initiatives, which slowly lead the community of mathematics educators to become a community of researchers in the new discipline of mathematics education, (see Bishop, 1992; Dreyfus and Paola, 2004; Freudenthal, 1968-1969; Kaufman, B.A. and Steiner, 1968-1969; Niss, 1999; Sierpiska and Kilpatrick, 1998). The wrench with the past was marked by the creation of the journal *Educational Studies in Mathematics* in 1968, which initially gathered the contributions of mathematics teachers and university mathematicians. This was the time of the birth of the ICME conferences. In this international movement Italy was represented by few persons. One of them, the secondary teacher Emma Castelnuovo, daughter of Guido, was member of the first editorial board of *Educational Studies in Mathematics*. The impact inside the country of what was happening abroad was confined to a few groups of researchers in some Italian universities. Some good projects for renewing the mathematics teaching were carried out under the guidance of mathematicians, who were interested in mathematics teaching. Until ICME 5 in Berkeley (1984) the Italian participants to ICME conferences were very few. As a consequence also the involvement in the activities of the affiliated Study Group (HPM¹ and PME) created in 1976 was very poor. Initially the conferences of the commission for improving the mathematics teaching CIEAEM were the main bridge of Italians with the international community. The sudden increasing of the number of Italian participants at ICME 6 (1988 in Budapest) may be taken as a mark in the internationalisation of our community.

Important aspects of the development of mathematics education research in Italy until the 1990s are outlined in (Arzarello and Bartolini, 1998). Moreover, since ICME 6 (Québec, 1992) the national community of mathematics educators has issued special books containing summaries of papers authored by Italian researchers and surveys of the Italian streams of research.

¹ HPM: History and Pedagogy of Mathematics Group; PME: International Group of the Psychology of Mathematics Education.

I feel that the Italian community has developed its own identity and independence from the mother-community of mathematicians, nevertheless I observe remarkable elements of continuity. Firstly, though our attitude towards rigour has strongly changed, still the interest for the approach to proof in secondary school is central in our research as for all the stages (exploring, conjecturing, proving) and for all mediators (paper and pencil, computer, mathematical instruments, language), (see Boero, 2002). Secondly, in Italy many groups of research are characterised by close collaboration of teachers and researchers in planning and carrying out educational studies. This contributes to make the relation between theory and practice less problematic than in other countries. Our research has always in mind the classroom. Unfortunately the position of teachers as researchers is also not officially acknowledged by the Ministry of Education and the involvement of teachers is voluntary and without official rewards. In conclusion, as chair of the HPM Study Group in the years 2000-2004, I can not forget the historical flavour present in many Italian works, which is a direct heritage of Enriques's and Loria's style of approaching mathematics education problems.

References

- Arzarello F. & Bartolini Bussi M. G. (1998). Italian trends in research in mathematics education: A national case study in the international perspective. In J. Kilpatrick and A. Sierpiska (editors), *Mathematics education as a research domain: A search for identity*, Kluwer Academic Publishers, Dordrecht/Boston/London, v. 2, 243-262.
- Boero, P. (2002). The approach to conjecturing and proving: cultural and educational choices. *Proceedings of 2002 International Conference on 'Mathematics: Understanding proving and proving to understand*, 248-254.
- Bishop, A.J. (1992). International Perspectives on Research in Mathematics Education. In D.A.Grouws (Ed) *Handbook of research on mathematics learning and teaching*, Macmillan, New York. 710-723.
- Castelnuovo, G. (1911). Commissione internazionale per l'insegnamento matematico. Riunione della Commissione internazionale a Milano. *Bollettino della "Mathesis"*, a. 3, 172-184.
- Dreyfus, T. and Paola, D. (2004). TSG 28: New trends in mathematics education as a discipline. *ICME-10 Proceedings*.
- Freudenthal, H. (1968-1969). Why to teach mathematics so as to be useful. *Educational Studies in Mathematics*, 1, 3-8.
- Kaufman, B.A. & Steiner, H.-G. (1968-1969). The CSMP approach to a content-oriented, highly individualized mathematics education. *Educational Studies in Mathematics*, 1, 312-326.
- Furinghetti, F. and Somaglia, A. (2005). Emergenza della didattica della matematica nei primi giornali matematici italiani. In D. Moreira & J.M. Matos (Eds.). *História do ensino da Matemática em Portugal*, 59-78.
- Howson, A.G.(1982). *A history of mathematics education in England*, C. U. P., Cambridge etc.
- Niss, M. (1999). Aspects of the nature and state of research in mathematics education', *Educational Studies in Mathematics*, 40, 1-24.
- Sierpiska, A. and Kilpatrick, J. (Eds) .(1998). *Mathematics education as a research domain: a search for an identity*, Kluwer Academic Publishers, Dordrecht/Boston/London.