To be a researcher in Mathematics Education in the Italian cultural and school context

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SALIENT STEPS OF MY PERSONAL PROFESSIONAL TRAJECTORY

- **From my political engagement in parallel with research in pure mathematics** (1964-1970), to my **fight against Modern Mathematics** (1970-1975), after having met J. Dieudonné and Modern Mathematics in schools in Nice (1969-1971) - with its **discriminating effects** on children from poor or diverse cultural background
- To my engagement in **teacher education & didactic innovations with teachers** (1973-1980), in the perspective of implementing new national programs in ompulsory school (1979; 1985), with a strong engagement in the elaboration and **large experimentation of innovative and comprehensive projects for lower secondary** (1996-2002) and **primary** (since 1980) **school.**
- To my **approach to research** in an unsuitable place (CIEAEM) (1980-1984)
- To my **approach to research in a more suitable place** (French Summer School in Didactics of Mathematics,1982-1999) and in the debates with some German, English and USA researchers (1984-1988)
- To the gradual **orientation (**since 1985) of the Genoa researchers & teachers team **towards research on/for the development of existing innovative projects** in school, in the perspective of "**research for innovation**", afterwards theorized by Arzarello & Bartolini Bussi (1999)
- To the collective engagement in **research organization** in Italy (National Research Seminar, since 1985)
- To my encounter with the **PME community** (since 1989 on, with 27 Research Reports and 3 Research Forums as presenter or co-presenter)
- To my engagement in preparing a **new generation of researchers**, in collaboration with foreign researchers (since 1996)
- To more recent interests in the various kinds of **mathematical and non mathematical rationalities**, in the perspective of **giving value to the richness of the "local" cultural roots of mathematical thinking in the necessary encounter with globalized mathematics and globalized mathematics teaching** (since 1999)
- To my collaboration (since 2012) with **INVALSI** (the ministry agency which produces and manages national tests for grades 2, 5, 8, 10), as a concrete occasion to contribute to the **evolution of the school teaching of mathematics in Italy.**

Permanent conditions of the Italian school system in the last four decades which demand(ed), and allow(ed), an engagement of university mathematicians in the renewal of school teaching of mathematics through the elaboration and experimentation of **wide, long term educational projects**:

- Programs and (more recently) guidelines for curricula are **prescriptive in a rather smooth way,** in comparison with other countries; moreover teachers and textbook authors feel free of interpreting them in rather personal ways
  <frequently in a transmissive, traditional way – but also **innovative experiences, even beyond the borders of the ministry texts**, are possible, thus **preparing further evolution of programs & guidelines**>
- The quality of national programs and (more recently) guidelines for curricula is rather good, also depending on the engagement of **researchers in mathematics education, mathematics educators and mathematicians** in their elaboration (within the Ministry commissions that prepare them). In particular the Guidelines for Primary School Curricula (from 2003 to 2012) were strongly influenced by the previous work of a Commission including mathematicians, **researchers in mathematics education** and delegates of the Ministry of Education=> "**Mathematics for citizenship" document**
- Probably depending on a long historical tradition of relevance in Italy of Catholic Church in education (including teacher education), many school teachers (particularly in elementary school) feel engaged in **general education of students**, and not only in the teaching of school disciplines. It contributes to the elaboration and implementation of **teaching projects conceived in a wide cultural and pedagogical perspective**.

Particular conditions that *till the end of the last century* created a good environment for the development of innovative teaching projects and related research activities in several universities:

- Some renowned mathematicians engaged in the renewal of the teaching of mathematics in school with teaching projects, collective documents, in-service teacher training activities (according to an ancient historical tradition, since the end of the XIX century, of engagement of Italian mathematicians in educational issues) ;
- Some of them encouraged their brilliant university students interested in educational issues (in some cases, due to political motivations) to engage in research in mathematics education strictly related to didactic innovations;
- The research funding agency (National Council of Research), under the impulse of some mathematicians who were members of the Committee for Mathematical Sciences, for more than two decades (1975-1995) gave money for projects aimed at the renewal of the school teaching of mathematics, and research fellowships for young people engaged in such projects (end of the seventieths).

Particular, inner conditions that favored the creation of a critical mass of university researchers engaged in mathematics education as their main research task

(since the beginning of the eighties):

- A generation of young mathematicians felt the necessity of a social engagement in EDUCATION in the specific field of MATHEMATICS TEACHING AND LEARNING
- The **example** of some renowned mathematicians concretely engaged in mathematics education legitimated and encouraged such interests
- The interest for a **mutual** (also **very conflictual**!) **exchange**,
  - since 1980, concerning the innovative projects (through national yearly meetings of researchers & teachers teams engaged in those projects) ,
  - then also concerning the development of research in mathematics education in Italy (since 1985, National Research Seminar)
- The diversity of **epistemological and cultural positions** on mathematics (structuralism/formalism, pragmatism,…) and of **references to research frameworks and traditions** at the international level (**French Didactics of Mathematics, neo- Vygotskian trends**, **constructivism**)

SOME PERSONAL, PERMANENT INNER CONFLICTS AND DOUBTS, WITH REFERENCE TO THE CONTEXTS OF THE ITALIAN SCHOOL SYSTEM AND OF THE COMMUNITY OF ITALIAN RESEARCHERS:

- Inner conflict between the **demand from school** (frequently mediated by teachers who are members of the Genoa research team) and **my interest for research on subjects** that may have a limited, immediate impact in school, but are aligned with current research trends in mathematics education (e.g. **argumentation and communication vs conceptualization**), or may have an interest as basic research problems (e.g. **mental dynamics in conjecturing and proving**);
- Inner conflict (and related doubts) between the aim of improving the teaching of mathematics, and the awareness of the **reality** of the teaching of mathematics in school as a **powerful tool** for **social control (mental discipline, convergent thinking, adhesion to unquestionable rules)** & **social discrimination, only partly related to students' mathematical potential** (does the engagement in research and innovation in mathematics teaching favor the functioning of the present school system in its worse role by smoothing the students' and teachers' difficulties in mathematics and promoting the relevance of mathematics teaching?).

ONE PRESENT INNER CONFLICT

- … **between the present, positive reality of INVALSI national tests for mathematics** in grades 2, 5, 8, 10, - prepared by groups of school teachers (more than one hundred, each year) coordinated by a national team and aligned with the National Guidelines for Curricula,
  - with a growing impact in school (bad textbooks are abandoned, teachers are induced to read national guidelines for curricula...), **which encourages me to collaborate with INVALSI,**
- ... and the **intrinsic limitations of testing** (even if more and more open questions are proposed, and the quality of items increases): - **complex competencies** cannot be tested (and thus the danger is to underestimate their relevance in school teaching); - **teaching to the test** spreads in schools, in several cases with **good effects**, thanks to the alignment with National Guidelines for Curricula (in comparison with traditional transmissive teaching), but in some cases with **bad effects** (in comparison with the potential of a wide-scope good teaching by a **minority of teachers**)

From my trajectory as a mathematics educator, to a look to the future

I see some problems that might compromise the **originality of the Italian contribution** to research in mathematics education at the international level:

- The need of **publishing in international journals and volumes for career reasons**: it encourages researchers to produce studies related to short term laboratory-style interventions, strictly related to the evolution of research in leading countries;
- The present **divorce** between young researchers' **political engagement** and their **profession of researchers**, which results in a more technical, less culturally and pedagogically engaged research effort;
- The problematic **belonging of researchers to the mathematics institutional environment**, where mathematicians personally engaged in research are now very rare, and a **very limited turn over (for national budget reasons)** increases the mathematicians' appetites for **professorships in pure and applied mathematics only**;
- The difficulty of teachers to take part as researchers in present research teams, because today research standards require to work at a **very sophisticated level** (concerning theoretical background, knowledge of the literature, research methodology).