

GIORGIO BOLONDI- CV

Current position

I currently hold academic tenure as a Full Professor in the Department of Mathematics at the Libera Università di Bolzano, a position which I formerly held at the Department of Mathematics of the Alma Mater Studiorum-Università di Bologna (2005-2017) and the Department of Mathematics of Politecnico di Milano (1997-2005).

Participation as trainer and coordinator to activities finalised to the construction of standardised tests

Since 2008, when the first censuary National testing in Grade 08 was established, I am involved in the preparation, validation and analysis of INVALSI tests.

In particular, I participated as coordinator and trainer to the activities finalised to the production of standardised mathematics tests organised by Invalsi in:

Dobbiaco (2013), Dobbiaco (2014), Dobbiaco (2015), Napoli (2015), Dobbiaco (2016), Napoli (2016), Dobbiaco (2017), Roma (2017), Dobbiaco (2018), Dobbiaco (2019), Dobbiaco (2020), Dobbiaco (2021).

Production of Mathematics Tasks

During the seminars quoted above, I also produced mathematics items that have been used in the National assessment. My items have been classified and recorded at the end of each seminar.

Moreover, I submitted items in occasion of the different calls by Invalsi. They can be tracked inside the Invalsi system.

Courses in Didactics of Mathematics

University courses- among many others:

Free University of Bozen-Bolzano: “Elementi di base di matematica e indicazioni didattiche 1+2” (2017/18); “Elementi di base di matematica e indicazioni didattiche 3+4” (2017/18, 2018/19); “Elementi di base della matematica per la sua didattica” (2018/19; 2019/20; 2020/21), CdS in Scienze della Formazione Primaria.

Alma Mater Studiorum- Università di Bologna: “Didattica della Matematica” (2015/16, 2016/17), CdS Magistrale in Matematica; “Fondamenti di Matematica e Didattica della Matematica” (2016/17), CdS in Scienze della Formazione Primaria.

Higher Professional development for teachers:

Direttore e docente del Corso di Alta Formazione Universitario "Leggere i Dati Invalsi" (FAM-Università di Bologna- A.A. 2016/17);

Direttore e docente del Master Universitario di II livello “Professione Formatore in Didattica della Matematica” (MIUR- Università di Bologna- A.A. 2013/14 e 2014/15);

Membro del Consiglio Direttivo e docente del Corso di Perfezionamento in Didattica della matematica per l'insegnamento nella scuola elementare (Università di Trento- A.A. 1998/99 e 1999/2000);

Coordinatore del Corso di perfezionamento universitario in Didattica della matematica: giochi di matematica per la scuola elementare (Università di Trento- A.A. 2001/2002).

Invited plenary lectures at international congresses (recent years)

- Bilbao, Spagna, luglio 2014, First Joint International Meeting of the Italian and Spanish Mathematical Societies

- Medellin, Colombia, maggio 2014, VI Congreso Internacional de Formación y Modelación en Ciencias Básica

- Santa Marta, Colombia, settembre 2015, Congreso Internacional: Didáctica de la matemática. Una mirada epistemológica y empírica

- Lille, Francia, novembre 2016, Mathematics and National Encyclopedias

Scientific metrics

I have authored over 120 research articles, 3 books as well as acting as editor of various books on teacher training and mathematics teaching.

Google Scholar: 703 citations; h-index 14; i10-index 22.

Scopus: 29 documents; 138 citations; h-index 7.

Web of Science: 32 documents ; 226 citations ; h-index 7.

Scientific interests

My scientific research began in the field of Mathematics, specifically Complex Geometry (1980-1984). My PhD thesis at the Université de Nice (FR) led me to the study of Algebraic Geometry, particularly the classification of projective curves (1984-1990). The last part of this research (1990-2000) involved a study of larger geometric objects (surfaces of four-dimensional spaces and subcategories of co-dimension two of projective space).

In the same period, I began to look at historical and epistemological issues, particularly concerning educational-related issues. I researched the early twentieth century debate over the meaning and origin of geometry postulates (epistemological, logical and didactic aspects); Federigo Enriques (at the origin of Italian research in mathematics teaching); the impact of Bourbakist ideology on approaches to mathematics teaching worldwide in the mid-twentieth century.

Since 2000, my research studies have centred upon mathematics teaching and learning and the professional development of mathematics teachers.

My main research topics in the last years have been:

- The use of videos in training of mathematics teachers
- How standardised assessments results can drive research in Mathematics Education
- Epistemology of the evolution of Mathematics Curricula

- The role of the formulation in a mathematical task
- Diagnostic tools based on Large-scale assessment results
- Didactic contract in Mathematics learning
- Gender gap in Mathematics results
- Virtual Mathematics classroom
- The connection between linguistic skills and mathematics skills
- Learning, loss, learning lack, learning gap during the pandemic
- The conceptual changes in thinking of mathematics teachers regarding probability
- Analysis of written mathematics tests in the Scientific High School Diploma Exam

I am currently involved in the following research projects:

- Building a repository of videos showing evaluation of mathematics training, and establishing teacher training models where these videos can be used (international project financed by a Comenius European grant)
- Bridging the gap between systemic educational data and on-the-field teachers actions
- Planning, testing and implementation of data mining processes for classification of results of standardized evaluation procedures
- Study of the effect of variations in mathematical task formulation
- Establishment of training courses for teachers in use of dynamic geometry software
- The gender gap in mathematics learning: quantitative and qualitative mixed-method approach
- Definition and implementation of a blended model for detection of correct answers to an open-ended question in computer-based testing.

I supervised 7 doctorate theses and 8 research fellowships in Algebraic Geometry and Mathematics Education, and more than 200 bachelor, master and specialization thesis.

Appointments

I was President of the Italian Commission for Mathematical Instruction as part of the Italian Mathematics Union (2009-2012) and Italian representative at the International Commission for Mathematical Instruction.

I served as Council Delegate (1996-2000, 2001-2004) of the European Mathematical Society.

Institutional role: national curricula and national assessments

I was a member of the official teams of experts who collaborated on

- the writing of the national curricula for Mathematics (“Indicazioni Nazionali”) for the High School Education System (National Curricula for grades 9-13)
- the writing of national curricula for Mathematics (“Indicazioni Nazionali) (national Curricula for grades K1-8))
- the establishment of new mathematics curricula in the Republic of San Marino
- the establishment of professional teaching and training courses for elementary/middle school mathematics teachers in the Canton of Ticino
- the writing of the Framework of the Mathematics National assessments (“Prove INVALSI”)

Participation in projects

I have participated in the following projects:

- expert of the work group that coordinates the implementation of Mathematics Invalsi Tests
- member of the Scientific and Technical Committee for the national PQM project (Quality and Merit Project)
- member of the Scientific and Technical Committee for the national M@tabel project
- vice-president of the Meetings with Mathematics Association, which organizes the international congress *Incontri con la Matematica* (Meetings with Mathematics) in Castel San Pietro Terme, the largest Italian conference for Mathematics teachers
- member of the scientific committee of PRISTEM
- co-ordinator for the Italian Mathematics Union in correction work on the international survey IEA-TIMSS
- collaborator with FIZ of Karlsruhe for a project of cataloguing and categorization of JFM
- responsible of more than 100 programs for teacher professional development organized by school institutions
- organizer of a work team for the Italian Commission for Mathematical Instruction (Italian Mathematics Union) which drafted the CIIM-UMI proposal for curricula in the two-year upper secondary school stage
- a member of the scientific council of the Marino Golinelli Foundation of Bologna
- responsible of the area “Advanced schools” of the European networks *Europroj e Eager*;
- Co-PI of the Comenius project *Famt&L, Formative Assessment in Mathematics Teaching & Learning* (EU-funded)
- PI of the project *GeGaMath- Gender gap in Mathematics Education*
- PI of the project *VirMATH- Virtual Mathematics Classrooms*
- PI of the projects *ARGOP* and *ARGOP2- Argumentation in Open-ended questions in Computer-based Testing*
- Coordinator for the Italian Mathematics Union of the project “Ricorrezione delle prove scritte di Matematica dell’esame di Stato”

Teaching experience

I taught more than 120 University courses (bachelor, master, doctoral) at Alma Mater Studiorum (University of Bologna- also in joint venture with Carnegie Mellon, Pittsburgh), Milano Politecnico, Milano Bicocca, Camerino, Università Cattolica di Brescia, Trento, Sassari, Libera Università di Bolzano

I was:

- Director and teacher of the del Corso di Alta Formazione Universitario "*Leggere i Dati Invalsi*" (FAM- Università di Bologna- A.A. 2016/17)
- Member of the Direction Council and teacher of the Corso di Perfezionamento in *Didattica della matematica per l’insegnamento nella scuola elementare* (Università di Trento- A.A. 1998/99 e 1999/2000)
- Coordinator of the Corso di perfezionamento universitario in *Didattica della matematica: giochi di matematica per la scuola elementare* (Università di Trento- A.A. 2001/2002)
- Director and teacher of the Master Universitario di II livello “*Professione Formatore in Didattica della Matematica*” (MIUR- Università di Bologna- A.A. 2013/14 e 2014/15);

- Organizer and teacher of the course *Formazione dei Formatori in didattica della Matematica* (Trento)
- Responsible of the training of the Mathematics area for the National Program of Teacher professional development on the international surveys (OCSE-Pisa e IEA-TIMMS) in the national conferences of Roma (2009), Monte Porzio Catone (2009), Giardini Naxos, (2010), Terrasini (2011)
- Teacher on behalf of INDIRE in the seminars of the national project PQM (Progetto Qualità e Merito, (national seminars of Roma; Cosenza; Napoli; Bologna; Bari)
- Member of the group of the authors of Mathematics tests (INVALSI schools of Roma (2011), Dobbiaco (2014, 2015, 2016, 2017, 2018, 2019), Napoli (2015, 2016),

Organization of meetings and workshops

- LOC chair of the II general Europroj meeting (Trento, 1991)
- LOC chair of the international conference “AGE-EUROPROJ 1997” (Alghero 1997)
- Member of the scientific committee of the annual conference “Incontri con la Matematica”, Castel san Pietro Terme (from 2017)
- LOC chair of 8 Europroj advanced schools for perspective teachers (Trento and Levico Terme, 1994-2002)
- Organizer and scientific director of the Workshop on “Theory of Objectification” (Brixen, 2020)
- LOC chair and member of the IPC of the 12th CERME conference (Bolzano, 2022)

Exhibitions and Science festivals

- Curator of the Italian edition of the exhibition *Boules et Bulles* (Festival della Matematica di Roma, Festival della scienza di Genova, Bergamo scienza, Perugia POST Festival...), more than 30,000 visitors
- Curator of the Italian theatrical staging of mathematics theatre *performance Bulles...j'ai fait un reve etrange*, with more than 3,000 spectators and many collateral events (exhibitions, presentation, workshops for teachers and students)
- Curator of the exhibition *Le geometrie impossibili di Oskar Reutersvaard*, set up in many locations (Popsophia festival)
- Curator of the scientific section of the *Biennale d'arte e cultura Tuttoingoco* (more than 100.000 spectators, Civitanova Alta 2009)
- Curator of the scientific section of the *Festival Popsophia* (Civitanova Alta, 2011; Pesaro 2013)
- Organizer of the *Festa della Matematica* (Termoli, 2011)

Research activities for overseas institutions

- Università di Barcellona (in diverse occasioni tra il 1987 e il 2004): attività di ricerca presso il dipartimento di matematica in collaborazione con la prof.ssa Rosa Maria Mirò-Roig;

- INCREST di Bucharest (giugno 1986): attività di ricerca presso l'INCREST in collaborazione con il prof. Constantin Banica e il prof. Iustin Coanda;
- Banach Center di Varsavia (maggio 1985): attività di ricerca presso il Banach Center in collaborazione con il prof. Stanislaw Łojasiewicz;
- Queen's University (Kingston, Can) (luglio 1991): attività di ricerca presso il Department of Mathematics in collaborazione con il prof. Tony Geramita;
- Notre Dame University (South Bend, USA) (luglio 1991): attività di ricerca presso il Department of Mathematics in collaborazione con il prof. Juan C. Migliore;
- Universidad Complutense di Madrid (dicembre 2000): attività di ricerca presso il Dipartimento di Matematica in collaborazione con il prof. Enrique Arrondo;
- Politecnico di Oslo (ottobre 1992): attività di ricerca presso il Dipartimento di Matematica in collaborazione con il prof. Ian O. Kleppe;
- Università di Nice (FR) (in diverse occasioni tra il 1982 e il 2000); attività di ricerca presso il Dipartimento di Matematica sotto la direzione del prof. André Hirschowitz;
- Università di Paris V (FR) (febbraio 1992): attività di ricerca presso il Dipartimento di Matematica sotto la direzione del prof. Christian Peskine;
- Universidad Distrital Francisco José de Caldas (Bogotà, COL) (febbraio 2012): attività di ricerca in collaborazione con il prof. Bruno D'Amore;
- Universidad Distrital Francisco José de Caldas (Bogotà, COL) (maggio 2014): attività di ricerca in collaborazione con il prof. Bruno D'Amore;
- Institut de Recherche sur L'Enseignement des Mathematiques di Lille (FR) (a più riprese tra il 2009 e il 2014): attività di ricerca in collaborazione con il prof. Valerio Vassallo;
- Scuola Universitaria Superiore della Svizzera Italiana (CH) (a più riprese tra il 2008 e il 2012): attività di ricerca in collaborazione con la prof.ssa Silvia Sbaragli.

25 selected publications

- 1) *An analysis of Differential Item Functioning on INVALSI tests, designed to explore gender gap in mathematical tasks* (with C. Giberti and C. Cascella). **Studies in Educational Evaluation**. Vol. 64, March 2020.
- 2) *Quantifying Solid Findings in Mathematics Education: Loss of Meaning for Algebraic Symbols*. (with F. Ferretti). **International Journal of Innovation in Science and Mathematics Education**, 29(1), pp. 1-15
- 3) *National standardized tests database implemented as a research methodology in mathematics education. The case of algebraic powers*. (with F. Ferretti and G. Santi). In: Jankvist, U. T., Van den Heuvel-Panhuizen, M., & Veldhuis, M. (Eds.), **Proceedings of the Eleventh Congress of the European Society for Research in Mathematics Education**. Utrecht, the Netherlands: Freudenthal Group & Freudenthal Institute, Utrecht University and ERME
- 4) *Monomials and polynomials: the long march towards a definition* (with F. Ferretti, A. Maffia). **Teaching Mathematics and its Applications: An International Journal of the IMA**, Oxford University Press, hry015, Volume 39, Issue 1, March 2020, Pages 1–12.
<https://doi.org/10.1093/teamat/hry015>
- 5) *This cannot be the result! The didactic phenomenon “The age of the Earth”* (with F. Ferretti). **International Journal of Mathematical Education in Science and Technology**. Sept. 2019. DOI:10.1080/0020739X.2019.1670366
- 6) *Difficulties in formulating a geometric situation algebraically; hints from a large-scale assessment* (with S. Pozio). In: M. Graven, H. Venkat, A. Essien & P. Vale (Eds.) **PME 43. Proceedings of the 43rd Conference of the International Group for the Psychology of Mathematics Education** (Vol. 3, pp 225-232). Pretoria, South Africa: PME. ISBN (Volume 3, print): 978-0-6398215-4-2. ISBN (Volume 3, electronic): 978-0-6398215-5-9
- 7) *A quantitative methodology for analyzing the impact of the formulation of a mathematical item on students learning assessment* (with L. Branchetti, C. Giberti). **Studies in Educational Evaluation**, vol.58, 2018, 37-50. <https://doi.org/10.1016/j.stueduc.2018.05.002>
- 8) *National standardized tests database implemented as a research methodology in mathematics education. The case of algebraic powers*. (with F. Ferretti and G. Santi). In: Jankvist, U. T., Van den Heuvel-Panhuizen, M., & Veldhuis, M. (Eds.), **Proceedings of the Eleventh Congress of the European Society for Research in Mathematics Education**. Utrecht, the Netherlands: Freudenthal Group & Freudenthal Institute, Utrecht University and ERME.
- 9) *Gender differences and didactic contract: analysis of two INVALSI tasks on powers properties* (with C. Giberti, A. Zivelonghi). In Csikos, C., Rausch, A., & Szitány, J. (Eds). **Proceedings of the 40th Conference of the International Group for the Psychology of Mathematics Education** Szeged, Hungary:PME, 275-282. ISSN 0771-100.

- 10) *Point, Line and Surface, Following Hilbert and Kandinsky*. In V.Capecchi (Ed.): **Applications of Mathematics in models, artificial neural networks and arts..** Springer Science, 2010.
- 11) *La France du XIX siecle: le phenomene Bourbaki*. In C.Bartocci et P.G.Odifreddi (Eds.), **La Mathématique. Les lieux, les temps**, CNRS Editions 2009. (32 pagg.) ISBN 978-2271068170
Ed. francese di *La Francia del Novecento: il fenomeno Bourbaki*. In **La matematica. I luoghi e i tempi**, a cura di C.Bartocci e P.G.Odifreddi. Einaudi, Torino 2007. (32 pagg.) ISBN 9788806164249
- 12) *Federigo Enriques e la sezione di Matematica dell'Enciclopedia Italiana* In: **Filosofia e Storia del Pensiero Scientifico in Federigo Enriques**, a cura di O.P.Faracovi, Belforte Editore, 1998 (32 pagg.)
- 13) *Curves of maximum genus in the range A and stick-figures* (with E.Ballico, Ph.Ellia, R.M. Mirò-Roig) **Transactions Amer.Math.Soc.** (14 pagg.) <http://dx.doi.org/10.1090/s0002-9947-97-01917-x>
- 14) *Maximal rank curves and singular points of the Hilbert scheme* (with J.O.Kleppe e R.M.Mirò-Roig) **Compositio Mathematica** vol.77 (1991), 269-291
- 15) *The Lazarsfeld-Rao problem for liaison classes of two-codimensional subschemes of P^n* (with E.Ballico e J.Migliore) **American Journal of Mathematics** vol.113 (1991), 117-128 <http://dx.doi.org/10.1007/bf02599318>
- 16) *The structure of an even liaison class* (with J.Migliore) **Transactions Amer.Math.Soc.** vol 316 n.1 (1989) 1-37 <http://dx.doi.org/10.2307/2001271>
- 17) *Classification of maximal rank curves in the liaison class L_n* (with J.Migliore) **Mathematischen Annalen** 277 (1987), 585- 603 <http://dx.doi.org/10.1007/bf01457859>
- 18) *Quale identità per i docenti di Matematica?* **Nuova Secondaria**, XXXVIII/1, sett.2020, 84-87.
- 19) *Transfomar la evaluación estandarizada en evaluación formativa*. In: **Didáctica de la Matemática. Una mirada internacional empírica y teórica**. A cura di B. D'amore e M.I. Fandino Pinilla. Universidad de La Sabana, Bogota.
- 20) *What can we learn from large-scale surveys about our students learning of maths?* **AAPP Atti della Accademia Peloritana dei Pericolanti, Classe di Scienze Fisiche, Matematiche e Naturali**, 99, (2021), 99S1A4
- 21) *Mettere in formula*. (con S.Pozio). In (a cura di P. Falzetti) **I dati INVALSI per indagare e migliorare l'insegnamento della Matematica**. Franco Angeli, Milano (2021).
- 22) *Quanto conosciamo i nostri studenti? Il contributo del modello di Rasch*. (co C. Cascella). In (a cura di P. Falzetti) **I dati INVALSI per indagare alcune caratteristiche degli studenti italiani**. Franco Angeli, Milano (2021).
- 23) *Changing the order of factors does not change the product but does affect students' answers, especially girls' answers*. (con C. Cascella and C. Giberti). **Education Sciences**, 2021, 11(5), 201

24) *Somministrazione delle prove INVALSI dal 2009 al 2015: un patrimonio d'informazioni tra psicometriche e didattiche* (con C. Cascella). In P. Falzetti (Ed.), **I Dati Invalsi: Uno strumento per la ricerca**. Milano: Franco Angeli, 75-88. ISBN-13: 9788891767691.

25) *Highlights on gender gap from Italian standardized assessment in Mathematics* (con C. Cascella, C. Giberti). In J. Novotná & H. Moraová (Eds.), **14th International Symposium Elementary Maths Teaching: Equity and diversity in elementary mathematics education** Prague: SEMT, 393-403. ISBN 978-80-7290-955-1. WOS:000432421100008