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# Introduction to the Proceedings of the Twelfth Congress of the European Society for Research in Mathematics Education (CERME12)

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## About CERME12

The Eleventh Congress of European Research in Mathematics Education (CERME 12) took place virtually, hosted by the Free University of Bozen-Bolzano, Italy, from 2<sup>nd</sup> to 6<sup>th</sup> of February 2022, after a year's delay due to the pandemic. Jeremy Hodgen (UK) and Eirini Geraniou (UK) were chair and co-chair of the International Programme Committee (IPC), which comprised Giorgio Bolondi (Italy), Jason Cooper (Israel), Ana Donevska-Todorova (Germany / North-Macedonia), Çiğdem Haser (Finland / Turkey), Uffe Thomas Jankvist (Denmark), Leander Kempen (Germany), Esther Levenson (Israel), Nuria Planas (Spain) and Michiel Veldhuis (The Netherlands). Giorgio Bolondi and Federica Ferretti were chair and co-chair, respectively, of the Local Organizing Committee (LOC).

CERME12 hosted 27 Thematic Working Groups, listed in the table below. The TWGs 11 and 27 were new TWGs, created following a call launched just after CERME11, and a selection process involving the CERME12 IPC and the ERME board. They have both been very successful. Nine of the TWGs received so many submissions that they had to be split in two – more precisely the TWGs 01, 03, 05, 09, 14, 16, 18, 19 and 20. In the end, CERME12 had 27 TWG leaders and 110 TWG co-leaders.

Thematic Working Group	Leader	Co-Leaders
TWG1: Argumentation and Proof	Andreas Moutsios-Rentzos (Greece)	Orly Buchbinder (USA); Jenny Christine Cramer (Germany); Nicolas Leon (YR) until Aug 2021; and from Sep 2021: Viviane Durand-Guerrier (France); David A. Reid (Norway); Mei Yang

		(British Indian Ocean Territory/UK) YR
TWG2: Arithmetic and Number Systems	Elisabeth Rathgeb-Schnierer (Germany)	Judy Sayers (UK); Beatrice Vargas Dorneles (Brazil) until Sep 2021; Pernille Bødtker Sunde (Denmark) from Sep 2021; Renata Carvalho (Portugal) YR
TWG3: Algebraic Thinking	Dave Hewitt (UK)	Maria Chimoni (Cyprus); Cecilia Kilhamn (Sweden); Luis Radford (Canada) from Sep 2021; Jorunn Reinhardtsen (Norway) YR
TWG4: Geometry Teaching and Learning	Michela Maschietto (Italy)	Alik Palatnik (Israel); Lina Brunheira (Portugal); Chrysi Papadaki (Germany) YR
TWG5: Probability and Statistics Education	Caterina Primi (Italy)	Sibel Kazak (Turkey); Aisling Leavy (Ireland); Orlando Rafael Gonzalez (Thailand); Daniel Frischemeier (Germany) YR
TWG6: Applications and Modelling	Berta Barquero (Spain)	Susana Carreira (Portugal); Jonas Bergman Ärlebäck (Sweden); Katrin Vorhölter (Germany); Gilbert Greefrath (Germany) from Sep 2021; Britta Eyrih Jessen (Denmark) YR
TWG7: Adult Mathematics Education	Kees Hoogland (The Netherlands)	Javier Díez-Palomar (Spain); Fiona Faulkner (Ireland); Beth Kelly (UK) YR
TWG8: Affect and the Teaching and Learning of Mathematics	Stanislaw Schukajilow (Germany)	Inés M <sup>a</sup> Gómez-Chacón (Spain); Çiğdem Haser (Finland); Peter Liljedahl (Canada); Chiara Andrà (Italy); Hanna Viitala (Sweden) YR
TWG9: Mathematics and Language	Jenni Ingram (UK)	Kirstin Erath (Germany); Aurélie Chesnais (France); Ingólfur Gíslason (Iceland) YR

TWG10: Diversity and Mathematics Education: Social, Cultural and Political Challenges	Laura Black (UK)	Anette Bagger (Sweden); Anna Chronaki (Greece); Nina Bohlmann (Germany); Sabrina Bobsin Salazar (Brazil) YR
TWG11: Algorithmics	Christof Weber (Switzerland)	Janka Medova (Slovakia); Ulrich Kortenkamp (Germany); Simon Modeste (France); Piers Saunders (UK) YR until Oct 2021; Maryna Rafalska (France) from Oct 2021
TWG12: History in Mathematics Education	Renaud Chorlay (France)	Antonio M. Oller-Marcén (Spain); Jenneke Krüger (The Netherlands); Tanja Hamann (Germany) YR
TWG13: Early Years Mathematics	Bożena Maj-Tatsis (Poland)	Marianna Tzekaki (Greece); Esther Levenson (Israel); Martin Carlsen (Norway); Andrea Maffia (Italy) YR
TWG14: University Mathematics Education	Alejandro González-Martín (Canada)	Ghislaine Gueudet (France); Olov Viirman (Sweden); Athina Thoma (UK) YR; and from Sep 2021: Irene Biza (United Kingdom); Chris Rasmussen (United States); Ignasi Florensa (Spain) YR
TWG15: Teaching Mathematics with Technology and Other Resources	Alison Clark-Wilson (UK)	Ornella Robutti (Italy); Melih Turgut (Norway); Daniel Thurm (Germany) from Sep 2021; Gülay Bozkurt (Turkey) YR
TWG16: Learning Mathematics with Technology and Other Resources	Paul Drijvers (The Netherlands)	Florian Schacht (Germany); Nathalie Sinclair (Canada); Osama Swidan (Israel); Eleonora Faggiano (Italy) from Sep 2021; Seçil Yemen Karpuzcu (Turkey) YR
TWG17: Theoretical Perspectives and Approaches in Mathematics Education Research	Angelika Bikner-Ahsbahs (Germany)	Heather Johnson (USA); Anna Shvarts (The Netherlands); Abdel Seidouvy (Togo/Sweden) YR

TWG18: Mathematics Teacher Education and Professional Development	Janne Fauskanger (Norway)	Libuse Samkova (Czech Republic); Andreas Ebbelind (Sweden); Marita Eva Friesen (Germany) YR; and from Sep 2021: Tracy Helliwell (UK); Macarena Larrain (YR)
TWG19: Mathematics Teaching and Teacher Practice(s)	Reidar Mosvold (Norway)	Mark Hoover (USA); Siún Nic Mhuiri (Ireland); Edyta Nowinska (Poland/Germany); Helena Grundén (Sweden) YR
TWG20: Mathematics Teacher Knowledge, Beliefs and Identity	Fatma Aslan-Tutak (Turkey)	Miguel Montes (Spain); Francesca Martignone (Italy); Miguel Ribeiro (Brazil); Veronika Hubeňáková (Slovakia) YR
TWG21: Assessment in Mathematics Education	Paola Iannone (UK)	Francesca Morselli (Italy); Michal Ayalon (Israel); Michiel Veldhuis (The Netherlands); Gözde Kaplan Can (Turkey) YR
TWG22: Curricular Resources and Task Design in Mathematics Education	Shai Olsher (Israel)	Sebastian Rezat (Germany); Annalisa Cusi (Italy); Nataly Essonnier (France) YR
TWG23: Implementation of Research Findings in Mathematics Education	Mario Sánchez Aguilar (Mexico)	Boris Koichu (Israel); Morten Misfeldt (Denmark); Rikke Maagaard Gregersen (Denmark) YR until Aug 2021; Linda Marie Ahl (Sweden) YR from Sep 2021
TWG24: Representations in Mathematics Teaching and Learning	Anna Baccaglioni-Frank (Italy)	Carla Finesilver (UK); Michal Tabach (Israel); Kate O'Brien (USA/UK) YR
TWG25: Inclusive Mathematics Education – Challenges for Students with Special Needs	Petra Scherer (Germany)	Hana Moraova (Czech Republic); Michael Gaidoschik (Italy); Helena Roos (Sweden) YR
TWG26: Mathematics in the Context of STEM Education	Behiye Ubuz (Turkey)	Michele Stephan (USA); Clelia Cascella (Italy/UK); Nelleke Den Braber (The Netherlands) YR

TWG27: The Professional Practices, Preparation and Support of Mathematics Teacher Educators	Ronnie Karsenty (Israel)	Stefan Zehetmeier (Austria); Hilda Borko (USA); Alf Coles (UK); Bettina Rösken-Winter (Germany); Birte Friedrich-Pöhler (Germany) YR
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## Editorial information

These proceedings are available as a complete volume online on the ERME website and each individual text is also available on the HAL open archive, where it can be found through keywords, title or author name. This has been the practice since CERME9, to increase the visibility of the huge work done in CERME conferences.

This volume begins with texts corresponding to the three plenary activities of CERME12: the plenary lecture by Susanne Prediger (Germany) on “Enhancing language for developing conceptual understanding: A research journey connecting different research approaches”; the plenary lecture by Jeppe Skott (Sweden / Norway) on “Conceptualizing individual-context relationships in teaching: Developments in research on teachers’ knowledge, beliefs and identity”; and finally the panel discussion “Big Questions in Mathematics Education”. This panel discussion was led by Anna Baccaglini-Frank (Italy), Ingi Højsted (Faroe Islands) and Janka Medova (Slovakia), chaired by Michiel Veldhuis (The Netherlands) and moderated by Eirini Geraniou (UK/Greece). The two plenary speakers, Susanne Prediger and Jeppe Skott, each gave a response to the panel discussion.

After the plenaries, the reader will find 27 chapters corresponding to the work done in the TWGs of CERME12 (with combined introductions from all the split TWGs). These chapters follow a similar structure: they start with an introduction; then the long paper contributions (8-page papers) and the short poster contributions (2 pages) are presented – in alphabetical order by first author’s name.

There are two kinds of introductions to the TWGs, according to the team’s choice: short introductions (4 pages) presenting the contributions; or long introductions (8 pages), which propose, in addition, an analysis of the current research on the theme of the TWG, and perspectives for the future. TWGs 04, 06, 07, 09, 14, 15, 17, 18, 19, 22, 25 and 26 have chosen this form of long introduction.

The publication of these proceedings is the result of a collaborative work, involving the CERME12 IPC, the TWG leaders and co-leaders, the LOC chair and co-chair and the wider team at Bozen-Bolzano. Particular thanks are due to Katrin Lambacher. We warmly thank all these people for their involvement, and hope that this volume will contribute to the development of mathematics education research in Europe and beyond.