Discussion Group

DG1: Computational and Algorithmic Thinking, Programming and Coding in the School Mathematics Curriculum: Sharing Ideas and Implications for Practice

July 14, 21:30–23:00   **Location: T205**

Organizers: Max Stephens (The University of Melbourne, Australia); Djordje M. Kadijevich (Institute of Educational Research, Belgrade, Serbia); Zhang Qinqiong (Wenzhou University China)

Description:
Computational/algorithmic thinking, programming and coding are emerging areas of importance for mathematics thinking, increasingly being located across the school mathematics curriculum in some countries worldwide. This Discussion Group is intended to provide a forum for bringing together these international trends and their growing impact on the curriculum – both in the compulsory years of schooling as well as in the senior high school years. It is aimed at teachers, mathematics curriculum experts, and teacher educators who are engaged or keenly interested in these issues, mostly from a practical point of view.

Participants are invited to share recent developments from their own countries or their own teaching experience in one or more of the following three areas: 1) current or proposed curriculum provisions/developments from their home country; 2) relevant classroom/ teaching activities; and 3) resources to support teachers.

Planned Activities & Working Format & Responsible Person

21:30–21:45	**Short Introduction**	
	Introduction to the DG and its website	
21:45–22:05	**Current/Proposed Curriculum Provisions**	
	Discussion on four or more selected national examples (Max Stephens)	
22:05–22:25	**Classroom/Teaching Activities**	
	Presentation and discussion on selected classroom/teaching activities (Zhang Qinqiong)	
22:25–22:45	**Resources to Support Teachers**	
	Discussion of available resources to support teaching of CT/AT (Djordje M. Kadijevich)	
22:45–23:00	**Post Conference Developments**	
	Recommendations for continuing collaboration/discussion (Max Stephens)	

DG

DG2: Discussion Group on Mathematics Houses and Mathematics Museums throughout the World

July 14, 21:30–23:00   **Location: T206**

Organizers: Albrecht Beutelspacher (Justus Liebig University Giessen and Mathematikum, Giessen, Germany); Ali Rejali (Isfahan University of Technology and Isfahan Mathematics House, Isfahan, Iran); Christian Mercat (Lyon House for Mathematics and Informatics, Lyon, France); Abolfazl Rafiepour (Shahid Bahonar University of Kerman and Kerman Mathematics House, Kerman, Iran); **Yahya Tabesh** (Sharif University of Technology, Tehran, Iran)

Description:
After a fruitful Discussion Group at ICME-13 in Germany and the establishment of an International Network of Mathematics Houses [INMH] in 2016 [1], we are trying to work on the official structure of the network and discuss forms of cooperation between mathematics houses and mathematics museums throughout the world. Their success in enhancing mathematical awareness among their communities and their impact on mathematics education, as well as their challenges, can be discussed.

Questions:

1. What are the benefits of such institutes for popularizing mathematics and improving mathematics education? Do s Houses and Museums have a role beyond
2. What are the challenges they face?
3. How can mathematics institutions share activities and cooperate with each other?
4. How can their members benefit from other institutes in other parts of the world?
5. What are the effects of these institutes in mathematics education of the region around these institutes?
6. What is the network [INMH] and what could be its structure?

Planned Activities & Working Format & Responsible Person

21:30–21:35   **Opening Statements**
Lecture (Ali Rejali)

21:35–21:45   **What Are the Museums of Mathematics**
Lecture (Albrecht Beutelspacher)

21:45–21:55   **Opportunities for Innovative Multidisciplinary Learning at Mathematics Houses**
Lecture (Yahya Tabesh)

21:55–22:05   **What are the other roles of mathematics houses and mathematics museums for the society**
Lecture (Albrecht Beutelspacher)

22:05–22:20   **Challenges for Mathematics Houses**
Lectures (Abolfazl Rafiepour, Christian Mercent)

22:20–22:30   **A Report on the Belgium Mathematics House**
Presentation (Their representative)

22:30–22:40   **What are the effects of mathematics houses on education and the society**
Lecture (Christian Mercent)

22:40–22:45   **The Network and Its Structure**
Presentation (Ali Rejali)

22:45–23:00   **Discussion by the Audience and the Members of the Panel**
Discussion (Albrecht Beutelspacher)

DG

DG3: Revisiting Shulman's Notion of Pedagogical Reasoning: Looking Back and Looking Forward

July 14, 21:30–23:00   **Location: T209**

Organizers: Ban Heng Choy (National Institute of Education, Nanyang Technological University); Jaguthsing Dindyal (National Institute of Education, Nanyang Technological University); Joseph Boon Wooi Yeo (National Institute of Education, Nanyang Technological University)

Description:
Pedagogical reasoning is not a new concept. More than three decades ago, Shulman (1987) expounded this idea in his seminal paper, well known for its elaboration of pedagogical content knowledge (PCK). Shulman stated that teaching begins as an act of reason and continues as a process of reasoning. He also added that pedagogical reasoning forms the basis for all actions by the teacher. In his model for pedagogical reasoning and action, Shulman proposed that teaching begins with the act of comprehending what has to be taught, followed by the transformation of that knowledge for teaching the students, which is followed by actual instruction, and an evaluation of the students' learning. Finally teachers engage in reflections, which may lead to new comprehensions by the teacher.

Although the notion of PCK has been quite well-understood, the notion of pedagogical reasoning is still under-theorised (Loughran et al., 2016). Yet, pedagogical reasoning has been seen as an important component of teaching expertise (e.g., see Choy, 2016). If teaching actions are based on pedagogical reasoning, then how do we enhance the pedagogical reasoning of teachers to improve teaching? Or more

fundamentally, is there a need to reinterpret the components of pedagogical reasoning in light of the current contexts of teaching and learning? In this DG, we will discuss these questions. More specifically, we will critique this construct and propose possible modifications to the framework of pedagogical reasoning. In addition, we will also discuss the issues and challenges related to the development of teachers' pedagogical reasoning.

Planned Activities & Working Format & Responsible Person

21:30–21:40	**What is pedagogical reasoning and action?** The organisers will facilitate the introduction of the participants of this DG and present the key ideas needed in this DG.
21:40–22:00	**What are the components of pedagogical reasoning and what are the roles of each component in teacher education and professional development? What can we say about its relationship to Shulman's notion of pedagogical reasoning?** The participants will work in groups to critique one of the following components: Comprehension, Transformation, Instruction, Evaluation, Reflection, and New Comprehension.
22:00–22:30	The participants will present their critique and suggest ideas to modify/enhance/clarify the notion of pedagogical reasoning.
22:30–22:40	**What are some issues and challenges with enhancing teachers' pedagogical reasoning?** The organisers will summarise the ideas shared by the participants and lead a discussion on the issues and challenges to prepare for session 2.
22:40–23:50	**How can we move forward in our endeavor to enhance teachers' pedagogical reasoning?** The organisers will summarise the ideas and discussion to set up possible collaboration opportunities in the future.
22:50–23:00	**Summary and Closing**

DG4: Roles for Mathematicians in Math Education

July 14, 21:30–23:00   **Location: T213**

Organizers: Solomon Friedberg (Boston College); Patricio Felmer (Universidad de Chile); Carlos Kenig (University of Chicago); JongHae Keum (Korea Institute for Advanced Study); Jürg Kramer (Humboldt-Universität zu Berlin

DG

Description:
Aims: Mathematicians have played an important role in math education for many years; for example, mathematicians Felix Klein (the first President of ICMI), Hans Freudenthal, and Georg Pólya have contributed fundamentally. In the present landscape, with the emergence of many specialists in education and math education, sometimes grounded in other disciplines, there are more voices and more perspectives—both a challenge and an opportunity. The goal of this discussion group is to take stock of ways that mathematicians are presently contributing to math education, to consider what they can add to the field of math education as mathematicians and among these what roles are most important, and to ask what experiences and structures would be most useful in promoting future cooperation and contributions.

Underlying Ideas: Mathematicians have played many roles in math education, including the training of future teachers in the university, the support of in-service teachers (e.g. helping to promote their on-going engagement with mathematics), roles in public policy such as writing or reviewing K-QO math standards and ensuring that there is a close articulation between K-QO math and university-level math, and roles in advocacy for math education. There appears to be quite a bit of variation from country to country, with some countries having many mathematicians involved in K-QO math education and some having practically none. We believe it would be valuable to discuss the contributions of mathematicians explicitly (they are not mentioned in any of the TSGs), to reflect on what they are contributing as mathematicians with their specific training and perspectives, to discuss what can be done to promote involvement going forward (taking stock as well of obstacles and pitfalls), and to ask whether or not this could be a source of

the improvement of K-QO math in countries where there has been little connection between university level mathematicians and mathematics educators to date.

Planned Activities & Working Format & Responsible Person

21:30–21:55 **Discussion of the Involvement of Mathematicians in Pre-service Education**
Short introduction followed by participants' descriptions of involvement and discussion of roles for mathematicians in the preparation of future teachers (Organizing team)

21:55–22:15 **Discussion of the Involvement of Mathematicians with In-service Teachers**
Short introduction followed by participants' descriptions of involvement and discussions of contexts, roles and best practices for the involvement of mathematicians in work with in-service teachers (Organizing team)

22:15–22:35 **Discussion of the Involvement of Mathematicians in Math Education Policy**
Short introduction followed by participants' descriptions and discussion of the involvement of mathematicians in math education policy (Organizing team)

22:35–23:00 **Discussion of Connecting Mathematicians and Mathematics Educators Going Forward: Roles, Opportunities, Obstacles and Potential Pathways**
Overall discussion of the involvement of mathematicians in math education and possibilities for future engagement (Organizing team)

DG5: 70 Years' Development of Mathematics Textbooks in Primary and Secondary Schools in China

July 14, 21:30–23:00   **Location: W215**

Organizers: Li haidong (The Curriculum and Teaching Material Research Institute, People's Education Press); Zhou xiaochuan (The Curriculum and Teaching Material Research Institute, People's Education Press)

Description:
The theme is 70 years' development of Mathematics Textbooks in primary and secondary schools inChina

We will introduce 70 years' development of mathematics textbooks，especialy recent twenty years. The Chinese characteristics of textbook development，the method of textbook research，and the exploration of practical reform of textbook，will be mainly expounded. Finally, we will express our understanding of mathematics and mathematics education.

DG

Planned Activities & Working Format & Responsible Person

21:30–21:45 **70 Years Development of Mathematics Textbooks in Primary Schools in China**
Ding Guozhong, The Curriculum and Teaching Material Research Institute People's Education Press

21:45–22:05 **Mathematical Thoughts and Methods of Mathematics Textbooks in Primary Schools in China**
Zhou Xiaochuan, The Curriculum and Teaching Material Research Institute People's Education Press

22:05–22:25 **The Reform and Development of Chinese Mathematics Textbook in Secondary School Of 21st Century**
Li Haidong, The Curriculum and Teaching Material Research Institute People's Education Press

22:25–22:45 **Development of Digital Technology in Secondary School Mathematics Textbook**
Zhang Jinsong, The Curriculum and Teaching Material Research Institute People's Education Press

22:45–23:00 **Mathematics Culture in Secondary School Mathematics Textbook**
Song Lili, The Curriculum and Teaching Material Research Institute People's Education Press

DG6: Variations and Series of Tasks, Crossing the Approaches

July 14, 21:30–23:00　　　　　　　　　　　　　　　**Location: W111**

Organizers: Katalin Gosztonyi (Eötvös Loránd University of Budapest, Hungary); Charlotte de Varent (Université de Rennes 2, France); Luxizi Zhang (École Normale Supérieure de Lyon, France, East China Normal University, China); Alessandro Ramploud (University of Pisa, Italy)

Description:

This discussion group aims to extend a discussion led by some senior and young researchers from four different countries since some years about variations and series of tasks. Katalin Gosztonyi wrote her PhD (2015) on the comparison of the Hungarian reform of mathematics education led by Varga (pointing out the importance of structuring problems in series and networks) and the French "mathématiques modernes" reform. Charlotte de Varent wrote her PhD (2018) on the use of history in mathematics education, pointing out the importance of small numerical variations in Mesopotamian scholarly context. Luxizi Zhang is working on her PhD (Zhang, 2019) towards an analytic model of "teaching mathematics through variation" from the analysis of teachers' documentation work (Gueudet & Trouche, 2009) in China and France, making profit of the variation theory (Gu, Huang, & Marton, 2004) and the notion of didactic variable in the theory of didactical situations (Brousseau, 2002).

As the above mentioned examples illustrate, the 'variation perspective' (what will mean in the followings: variation as well as sequencing and networking of tasks and problems) appears as an important issue in various traditions of mathematics education, and at the core of teachers' documentation work. International discussions where launched on this topic since some years: the "Series of problems" interdisciplinary historical research project (2012-2019) (Bernard 2015), the first (2018, Budapest) and the second (2019 Lyon) "Variations and series of problems" workshop, and the Varga100 conference (2019 Budapest, https://varga100.sciencesconf.org/). The aim of these discussions was to confront different implementations of this 'variation perspective', towards a common model, or a diversity of models, allowing on one hand to develop analytical tools for researchers, and on the other hand to support teachers design work. We consider that the ICME14, in the country of the Chinese "variations method" and thanks to the diversity of the conference's public, would be a particularly well adapted context for the continuation of this collective work.

References

Brousseau, G. (2002). Theory of Didactical Situations in Mathematics. Netherlands: Springer.

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Gu, L., Huang, R., & Marton, F. (2004). Teaching with variation: A Chinese way of promoting effective mathematics learning. In L. Fan, N. Y. Wong, J. Cai, & S. Li (Eds.), How Chinese learn mathematics: Perspectives from insiders (pp. 309–347). Singapore: World Scientific.

Gueudet, G., & Trouche, L. (2009). Towards new documentation systems for mathematics teachers? Educational Studies in Mathematics, 71(3), 199-218.

Varent, de. C. (2018). Pluralité des concepts liés aux unités de mesure. Liens entre histoire des scienceset didactique, le cas de l'aire du carré dans une sélection de textes anciens. (Unpublished doctoraldissertation). Paris 7 Diderot University, Paris, France.

Planned Activities & Working Format & Responsible Person

21:30–21:40	**Introduction** (The coordinators, plenary)
21:40–21:55	**Presentation of the Chinese, Hungarian and French Handouts** (L. Zhang, K. Gosztonyi plenary)
21:55–22:15	**Analyzing the Data, Extracting Principles with Special Focus on the Structure of the Task Sequences. Comparing to the Participants' Teaching Traditions** Work in small groups.
22:15–22:35	**Sharing the Results of the Four Groups** Collective discussion

DG

22:35–22:45	**Italian Adaptation of the Chinese Variation** (A. Ramploud, plenary)
22:45–23:00	**General Conclusions + Potential Plans for Further Research** (The coordinators, plenary)

DG7: The Future of Mathematics Education Research:Discussion of an International Survey

July 14, 21:30–23:00 **Location: W315**

Organizers: Arthur Bakker (Utrecht University, the Netherlands); **Jinfa Cai** (University of Delaware, USA)

Description:
Mathematics education research as a discipline is celebrating several milestones. ESM and JRME have recently celebrated their 50th anniversaries. To mark this auspicious occasion, this DG focuses on the future of mathematics education research. We will use an international survey (conducted before and during the pandemic) as the basis of the discussion. The survey results have been published in 2021 in ESM (https://link.springer.com/article/10.1007/s10649-021- 10049-w). We aim to organize the best ideas for the future of mathematics education research into a form that ICMI members will find appropriate. In particular, we will discuss the impact of the pandemic on the shape of mathematics education and mathematics education research, including increased attention to issues such as online assessment and pedagogical considerations for virtual teaching.

Planned Activities & Working Format & Responsible Person

21:30–21:35	**Introduction and Brief Reflection** Looking back, and plan of the discussion group Jinfa Cai on the basis of Inglis and Foster (2018)
21:35–21:50	**Introduction and Brief Reflection** What do international voices say? Arthur Bakker on the basis of an international survey that appeared in Educational Studies in Mathematics in early 2021
21:50–22:00	**Personal Discussion** Relation of what has been discussed to the ICME survey from 2004 Anna Sfard (relating to Sfard, 2005)
22:00–22:30	**Break-out Session** Formulation of research questions at research program level (Moderated by all team members)
22:30–22:45	**Plenary Discussion** Sharing best ideas from the break-out session (Guangming Wang)
22:45–22:55	**Personal Discussion** What can ICMI learn from the discussions? (Jill Adler)
22:55–23:00	**Looking into the Future** What is the next step? (Arthur Bakker, Jinfa Cai)

DG8: Developing Teachers' Professional Competence and Improving Their Teaching Practice through Cross-cultural Programmes

July 14, 21:30–23:00 **Location: W201**

Organizers: Xingfeng Huang (Shanghai Normal University, China); Minxuan Zhang (Shanghai Normal University, China); Rongjin Huang (Middle Tennessee State University, USA); Shiqi Li (East China Normal University, China)

Description:
Since 2014, the UK government has funded the Mathematics Teacher Exchange Programme between UK-China to improve British teacher's professional development. Through this programme, nearly 1000

DG

teachers from both countries have visited schools in counterpart schools and learned teaching and teacher professional development practice from the other country. Over the past eight years, participating teachers have benefited from the exchange activities and improved their teaching practice. However, some contradictions have occurred due to cultural differences between China (the East) and the UK (the West).

Classroom teaching and teacher learning are cultural activities. Thus, the differences in mathematics teaching and teacher learning between the East and the West are rooted in their cultural values, educational philosophies and traditions, and practical wisdom. It is crucial to identify the strengths and weaknesses of mathematics education and understand the underlying cultural differences in order to learn from each other. The contradictions regarding mathematics teaching and learning between the East and the West could be the driving force for teachers' learning, and promote their self-reflection and teaching improvement. Therefore, based on these projects and research literature, this discussion group will focus on (1) what we can learn from the exchange programme between the Eastern and Western cultures; (2) practice and research on cross-cultural teachers' collaboration and learning in the future. This discussion is aimed to deepen our understanding of the theories and practice of mathematics teaching and teacher professional learning in the East and the West and improve our own mathematics education.

Planned Activities & Working Format & Responsible Person

21:30–22:00	**Sharing the Experience in and Research Findings on the Exchange Programme between UK-China** (Minxuan Zhang)
22:00–22:45	**Discussion:** **(1) Why it is necessary and important for teachers' collaboration cross-culturally;** **(2) What can be learned from the exchange programme between the Eastern and Western cultures;** **(3) Practice and research for teachers' cross- culture collaboration and learning in the future** (Rongjin Huang)
22:45–23:00	**Comments** (Jenni Ingram)

DG9: Non-university Tertiary Mathematics Education: An Emerging Field of Inquiry

July 14, 21:30–23:00   **Location: W203**

Organizers: David Tannor (Faculty of Mathematics, Kellogg Community College, USA); Laura Watkins (President-Elect, AMATYC; Faculty of Mathematics, Glendale Community College, USA); Kathryn Kozak (President, AMATYC; Faculty of Mathematics, Coconino Community College, USA)

Description:

The intent of this discussion group (DG) is to gather ICME-14 participants to engage in conversation about non-university tertiary mathematics education (NTME). Since ICME-9, it has been a tradition to dialogue about educational matters unique to this area. Over time, with both advances, challenges, and opportunities in tertiary mathematics education, as well as increasing attention, it is apparent that NTME is becoming a critical branch of inquiry in mathematics education. Yet, compared to primary, secondary, and university education, historically NTME has received insufficient attention. Consequently, this DG will provide an avenue to engage a wider group of mathematics educators, network, exchange ideas, and learn more about NTME practices around the world. The meaning of NTME as well as developing this area as a field of inquiry will be explored.

Planned Activities & Working Format & Responsible Person

21:30–22:05	**Introduction of Topic and Brief Presentation on Related Practices around the Globe** TBA
22:05–22:45	**Break-out Sessions for Small Group Discussion** TBA

DG10: Teaching and Learning Linear Algebra

July 14, 21:30–23:00   **Location: W211**

Organizers: Sepideh Stewart (University of Oklahoma, USA); María Trigueros (Instituto Tecnológico Autónomo de México, MEXICO); Michelle Zandieh (Arizona State University, USA)

Description:

This discussion group will draw on the experience of three Linear Algebra researchers and curriculum designers to facilitate discussions around the past and future of Linear Algebra education. Linear Algebra is an important area of study for STEM majors. In a survey paper by Stewart, Andrews- Larson, and Zandieh (2019) the authors summarized some advances in many areas of linear algebra education (e.g., span, linear independence, eigenvectors, and eigenvalues). The survey paper also identified areas that need more research (e.g., systems of linear equations, properties of linear transformations, orthogonality, and least squares), and revealed the gaps (e.g., proof).

This working group will provide the opportunity to continue to develop and extend the field. Key questions and issues to be discussed are: What do we know from research about the teaching and learning of Linear Algebra? How can research results be used in the teaching of Linear Algebra? What innovative teaching methods have proved some success in the teaching of Linear Algebra?

Planned Activities & Working Format & Responsible Person

21:30–21:40   **Introduction**
                      The organizers will give a brief overview of their research. Attendees will introduce themselves. The plan for the discussion group as well as a set of questions will be presented

21:40–22:05   **(a) Issues on First-year Linear Algebra Topics**

                      (b) Teaching Resources (Application, Technology)
                      The attendees will break up in small groups to discuss:
                      (a) What are some pressing issues concerning the teaching of first-year courses?
                      (b) What teaching resources do you use to help students to understand the concepts better?

22:05–22:30   **(c) Linear Algebra Proofs,**

                      (d) Second Courses in Linear Algebra
                      The attendees will break up in small groups to discuss:
                      (a) What are some issues surrounding teaching linear algebra proofs?
                      (b) What is the nature of second courses in your institution? The attendees will discuss the pertinence and possible contents of the second courses as a group.

22:30–22:50   Group discussion

22:50–23:00   **Closing Remarks, Supporting New Researchers, Future Work**
                      The organizers will close by summarizing participants' views about future research

DG11: How Do Movements Of Bodies and Artifacts Emerge in Mathematics Education?

July 14, 21:30–23:00   **Location: W303**

Organizers: Anna Shvarts (Utrecht University, The Netherlands); Dor Abrahamson (University of California, Berkeley, USA); Ricardo Nemirovsky (Manchester Metropolitan University, UK); Nathalie Sinclair (Simon Fraser University, Canada); Candace Walkington (Southern Methodist University, USA)

Description:

This discussion group is initiated by an international collective of researchers all concerned with embodied processes in mathematics teaching and learning. Operating from different perspectives that consider bodies as partaking in educational processes, we have been offering theoretical rethinkings of cognitive and affective processes in mathematical practices. This discussion group aims to consider the origins of movements performed by students, teachers, and artifacts. We invite group participants to reflect on resources initiating bodily movement and on the agents who perform or share the movement. We hope to articulate the difference between motion and movement as well as when and how movements become recognized as mathematical activity and discourse (language, diagrams, gestures). Imagine a student who draws the graph of $y=x^2$ on grid paper.

From a theory of dynamic systems that Abrahamson uses to argue for his embodied-design framework, this movement emerges as embodied adaptive coordinations in a complex dynamic system bearing agentive, environmental, and task constraints, such as figural features of the paper (Abrahamson & Sánchez–García, 2016). From a new-materialist perspective that Sinclar elaborates in the mathematics education field (de Freitas & Sinclair, 2014), an assemblage of the student with her capacities, the formula and the paper with the virtual transformation that they imply is actualised towards the graph. From a phenomenological perspective, in which Nemirovsky was engaged for many years (Nemirovsky, Kelton, & Rhodehamel, 2013), objectification of formula includes protention and retention of its usage, and the subject joins intentional horizon of the paper and retention formula usage in fulfilling her intentionality of drawing a graph by moving the hand along the paper. From an embodied cognitive science perspective that is within Walkington's expertise, movement is driven by cognitive processing of the formula that is extended beyond the scalp in a distributed system of activity that includes both explicit use of embodied resources and implicit embodied associations (Walkington et al., 2019). From a cultural-historical account, represented by Shvarts in the team (Shvarts & Abrahamson, 2019), the student's drawing is mediated by cultural artifacts—the paper and the formula—and expresses an ideal (cultural) form of action, which the student appropriated in a previous collaboration with a more knowledgeable other.

Group discussion will draw on a prepared audio-video excerpt from a mathematics teaching–learning episode featuring explicit bodily movement apparently relevant to mathematical conceptualization. Group participants will consider this excerpt to elaborate and debate theoretical perspectives as these illuminate agential sources and implications for practice. In the excerpt, there will be vivid involvement of the students, a teacher, and a technological artifact so that participants could draw their theoretical analysis on the enactment and gestures of all participants and interactive feedback from the artifact. Finally, we will discuss applications of the theoretical ideas to educational design and future research questions.

Planned Activities & Working Format & Responsible Person

21:30–22:00   **Introduction: The Vision of Agency from Different Theoretical Perspectives.**
A short introduction and five 5- minutes presentations by each of the team leaders

22:00–22:30   **Analysis of A Video Excerpt with a Movement in Technologically Enhanced Settings from Different Theoretical Perspectives.**
Five groups focus on different theories and moderated by a corresponding team leader who screen-shares the video fragment

22:30–22:45   **Exchange of Findings between the Perspectives.**
Moderated by the team leaders

22:45–23:00   **General Discussion: The Consequences of Each Theoretical Approach for Educational Design and Future Research Questions.**
Moderated by Shvarts

DG

DG12: Driving Forces behind School Mathematics Curriculum Change in Asia

July 14, 21:30–23:00   **Location: W313**

Organizers: Zahra Gooya (Shahid Beheshti University, Tehran, Iran); Soheila Gholamazad (Organization for Research and Education al Planning, Ministry of Education, Iran)

Description:
There are many different driving forces behind every mathematics curriculum change around the world including politics, values and culture. In recent time, one of the driving forces behind mathematics curriculum changes has been international assessment results. For instance, every four years, after the TIMSS results are released, many officials in various education systems tempting to take some remedial measures to improve their countries' ranking by the next TIMSS.

The scope of this proposal is to discuss the root causes of such hasty and sudden decisions. The proposers invite the audience to discuss the ways in which, school mathematics curriculum be altered and adjusted in such ways to keep the balance between local and global situations and to use research findings properly to suit different education systems.

Planned Activities & Working Format & Responsible Person

21:30–21:40	**Introducing the Aim of the DG** Rationale for DG (Zahra Gooya)
21:40–22:00	**Open the Floor for Participants to Discuss the Controversial or Emerging Issues and/or Dilemmas They Have Faced in Mathematics Curriculum in Their Countries** Driving forces behind mathematics curricula change/ reform in some of the Asian countries. Soheila Gholamazad (White/ chalk board)
22:00–22:15	**Discussion among Team Members & Participants** Major driving forces and controversial issues in math curriculum reform Chair & Co- chair (White/ chalk board)
22:15–22:35	**Challenging Participants with the Identified Issues in the 1st Meeting** The relation between local characteristics and math curriculum reform/ change A volunteer from team members/ participants (Video projector)
22:35–22:50	**Examining the Development of a Framework for Studying Math Curriculum Changes in Asia** A possible framework for studying math curriculum changes in Asia Soheila Gholamazad (Video projector)
22:50–23:00	**Planning Next DG?** Where to go from here? Whole participants (Video projector)

DG13: Capacity and Network Project Sustainablity and Future Directions

July 14, 21:30–23:00   **Location: W101**

Organizers: Anjum Halai (Aga Khan University Pakistan); Moustapha Sokhna & Mamadou Sangare (CANP1); Yuri Morales and Nelly Leon (CANP2); Maitree, Khamla and Vu Nhu Thu (CANP3); Alphonse Uworwabayeho and Veronica Sarungi (CANP4); Augusta, Gabriela and Maria del Carmen Bonilla Tumialan (CANP5)

Description:
This discussion group will be attractive to congress participants interested in creating networks and communities of practice in challenging and disadvantaged education contexts. Discussion will focus on the Capacity and Network Projects (CANP) of the International Commission of Mathematical Instruction (ICMI) supported by the International Mathematical Union (IMU), UNESCO and the International Council of Scientific Unions (ICSU) as well as regional governments and institutions. Five CANPs have been organised so far. While each CANP differs in its focus, approach and process the goal is to respond

to the challenges in mathematics education that have been documented among other reports in UNESCO 2011. The aims of the Discussion Group at ICME 14 include identifying, sharing and discussing common key issues in creating a critical mass to sustain the network and its activities over long term. Through sharing cross-national regional experiences, we expect to deepen and broaden the understanding of lessons learnt in the process of establishing the CANP and taking it forward.

Discussions will be guided by the following key questions:

a. What did the CANP do in 2020? How (if at) were your activities impacted by the pandemic? (focus on one or two innovations/activities).
b. What is planned for the CANP in 2021? Why?
c. What new questions arise for the mathematics education community?
d. What are the similarities and differences in the opportunities and challenges arising in the CANPs?
e. What is the impact of CANP on mathematics education in the region? how could the impact be sustained?

Planned Activities & Working Format & Responsible Person

21:30–21:45 **Short Introduction**
Introduction to the DG and its website

21:45–22:05 **Current/Proposed Curriculum Provisions**
Discussion on four or more selected national examples (Max Stephens)

22:05–22:25 **Classroom/Teaching Activities**
Presentation and discussion on selected classroom/teaching activities (Zhang Qinqiong)

22:25–22:45 **Resources to Support Teachers**
Discussion of available resources to support teaching of CT/AT (Djordje M. Kadijevich)

22:45–23:00 **Post Conference Developments**
Recommendations for continuing collaboration/discussion (Max Stephens)

DG14: Mathematics Education and Teacher Professional Development System in Jiangsu Province

July 14, 21:30–23:00   **Location: W301**

Organizers: Lianhua Ning (Nanjing Normal University, China); Ping Yu (Nanjing Normal University, China); Jingya Zhao (Nanjing Normal University, China); Xiaoyan Zhao (Nanjing Normal University, China); Shanliang Li (Institute of Teaching in Primary and Secondary Education in Jiangsu Province, China); Jiuhong Wang (Tianzheng Primary School, China); Guangming Wei (Experimental Primary School Affiliated with Jinling High School, China)

Description:
In Jiangsu Province, which has been considered as one of the provinces with highest educational development in China, a system at various administrative levels for facilitating professional development of mathematics teachers has been established. By means of setting expert mathematics teacher studio, supporting People Educators in mathematics education, strengthening the cooperation between researchers and in-service mathematics teachers etc., a great progress has been made in mathematics education at primary and secondary level in terms of mathematics teachers' capability of doing research.

In this discussion group, it will be shared with examples how these supporting systems helps to supporting mathematics teachers' professional development. More specific, various activities done in each of the three manners mentioned above will be given, with the aim of characterizing the advantages and challenges in such supporting system. Another aim of this discussion group is to gather more ideas for further improving such system in order to better help mathematics teachers' professional development.

Planned Activities & Working Format & Responsible Person

21:30–21:40 **Introductory Comments (Organizing the group discussion through the key questions)**
Whole group discussion (Ping Yu / Xiaoyan Zhao)

21:40–22:00	**System of and Strategies for Supporting Mathematics Teachers' Professional Development in Jiangsu Province**
	Presentation given by Lianhua Ning, Jingya Zhao and Shanliang Li
22:00–22:25	**Suitable for Development: Purport of Mathematics Teaching Wisdom under the Condition of Large Class Size**
	Presentation given by Jiuhong Wang
22:25–22:45	**Expert Mathematics Teacher Studios Driven by Research-based Teacher Professional Development Programme**
	Presentation given by Guangming Wei
22:45–23:00	**Closing comments –Summarize the presentations and Discussions, and Identify Follow-up Questions to Investigate**
	Whole group discussion (Organizing Committee)

DG15: Searching New Paradigms on Mathematics Teacher Education Research and Classroom Mathematics Assessment

July 14, 21:30–23:00   **Location: T105**

Organizers: Regina Ehlers Bathelt (UFSM, Brazil); **João Pedro Antunes de Paulo** (IFC, Brazil)

Description:

This discussion is proposal by some members of the SIGMA-t Group – an interinstitutional net of Brazilian researchers seek Mathematics Education research and development based on theoretical frame of the Model of Semantic Field (MSF) by Lins. Dr João Pedro Antunes de Paulo, Substitute Teacher of Federal Institute Catarinense. The aim of his research is understand the producing of MSF and what would be propose like a teacher education program in line with this theoretical model. Dra. Regina Ehlers Bathelt, Adjunct Teacher of Santa Maria Federal University, has seeking out "think outside the box" searching ways to read and understand theoretical-didactic models of mathematics education with implications to different curriculum production, use and evaluation of didactical materials and resources both, to mathematics teacher education' courses, and mathematics classrooms (primary and secondary schools). We intends congregate the community members of Mathematics Education who want discuss paradigms on mathematics teacher education and mathematics classroom assessment research, both "on the fly" actions of teaching and learning process. So, thinking mathematic' classrooms how do we make decisions on real didactical actions? What change in the classroom didactical actions world if we operate one or another theoretical world? During DG different theoretical worlds emerges and a reading of classroom situations produced. This "a read" highlight the difference among didactical actions supported by MSF and the counterparts presented. We hope at the end, the participants will be able to read in MSF another theoretical tool, especially productive to analyze the Mathematics classroom teaching-learning processes.

Planned Activities & Working Format & Responsible Person

21:30–21:50	**Introduction**
	The organizers will introduce their selves and present the general idea of DG. The attendants will present their selves
21:50–22:10	**Different Theoretical Frames/Different Mathematics Education Worlds– RME, DST, MSF and DTT**
	Regina Ehlers Bathelt Mathematics class episodes: Telling stories/ pedagogical discussion
22:10–22:25	**Curricular Proposal for Teacher Education/ Guidelines from MSF**
	João Pedro Antunes de Paulo Proposal analysis
22:25–22:55	**Discussion Group**
	Curriculum and differences: mathematics teacher education and evaluation on mathematics classroom.
22:55–23:00	**Closing Remarks**
	Questions to further research