WG14
University mathematics education

Leader:

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Welcome!

17.00 Welcome: from CERME7 to CERME8, and beyond!
17:10 Introduction to WG14 Subgroups
        (CW, EN, IB, AGM, GG)
        Schedule for Sessions 1-7
17:20 Introduction to today's group-work
        Splitting in small groups
17:30 Group-work
18:15 Small group presentations by nominated participant
18:45 Preliminary discussion of post-CERME8 collaboration
19:00 Closing

TEACHER/COMMUNITY
INTEREST/PERCEPTION
TRANSITION
MATHEMATICAL TOPIC
MATHEMATICAL DOMAIN
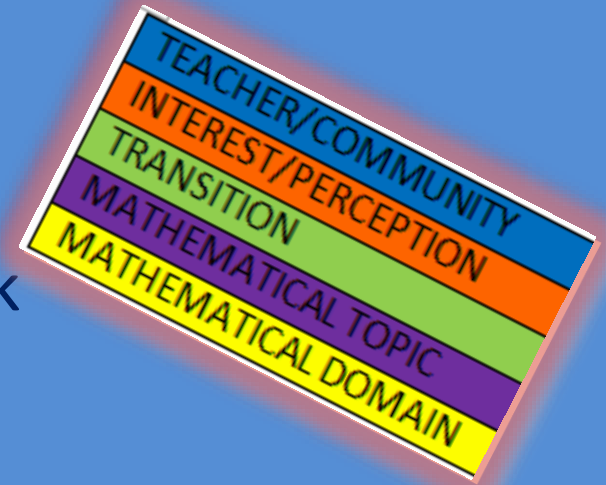
WG14: University mathematics education Session Outline

	February 5th	February 6th	February 7th	February 8th	February 9th	February 10th
	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
8 30		YERME DAY	WG Session 2		WG Session 6	
9 00			Carl	WG Session 4	Ghislaine	WGs Report 1
9 30				Irene		
10 00					Coffee break	WGs Report 2
10 30			Coffee Break + Poster session	Coffee break	Joint Report ERME – EMS EC	
11 00				WG Session 5		Coffee Break
11 30			Plenary Talk Alain Kuzniak	Alejandro	Plenary Talk Candia Morgan	Closing Ceremony
12 00		ERME meets Young Researchers Reception				
12 30			Lunch (ERME will welcome newcomers from 13.15 till 14.00.)	Lunch	Lunch	Lunch + Departures
13 00						
13 30	YERME DAY					
14 00		Opening Ceremony	Poster session	Excursion departure	ERME General Assembly	
14 30						
15 00						
15 30		Plenary Talk Paolo Boero	Coffee Break			
16 00			WG session 3		Coffee break	
16 30		Coffee break			WG Session 7	
17 00		WG Session 1	Elena		All	
17 30						
18 00		All	Forum	Excursion return	Results of elections	
18 30						
19 00		Dinner	Dinner	Dinner	Free time	
19 30						
20 00					Gala Dinner	
20 30						
21 00	Live Music	Turkish Contributions to Mathematical Sciences Cem Tezer	Live Music			

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* Work in four groups each led by GG, AGM, IB and EN. Subgroup CW includes 5 papers, 3 by co-leaders IB, GG and EN. These papers will be discussed within these co-leaders' small groups. The authors of the other two CW papers (Jaworski, Pinto) will discuss their paper within the subgroup they choose to attend. CW will join the IB group in which his paper belongs. Participants who are not authors can choose their groups freely.

**Small group-work agenda

Individual introductions

Please include your interests and expectations from the WG.

Preliminary discussion of papers

Please focus on the subgroup papers and any extra papers as in *. Focus on initial observations of commonalities and differences; and, on making the most of the time dedicated to these papers in Sessions 2-6.

Welcome by co-leader

*Paper Reminder-Presentation*s***** and *Reactions******

Discussion of papers in small groups******

Plenary summaries of small-group discussions

Plenary discussion

Closing

*Maximum 5 minutes long assisted *(optional) by one slide of at least 20pt font size.*
**20 minutes

Part I: Preparing Sunday's WG14 presentation

- Observations from co-leaders on themes across Sessions 2-6
- Discussion: the structure of Sunday's WG presentation
- Group-work on presentation sections
- Plenary discussion of group-work outputs and presentation drafting

Part II: Post-conference collaboration

- Preparations for the Proceedings
- *Beyond CERME8: Special Issue Proposal, PME37 etc.*

8.30-9.20 Paper reminder presentations + reactions (5'+5')

Bıza - Pınto - Gueudet - Jaworskı - Nardı

9.25-10.00 Discussion of five papers each in one group

NB: each group must choose

- a **moderator** to ensure the discussion focus on the **paper** : raise questions, identify main points, discuss possibilities and potentials
- a **reporter** to take notes (to be given to the team at end of session) and report back orally

10.00-10.25 Short reports from five groups + authors' final phrase (total $\leq$ 5 mins/paper)

NB: each **author** should take notes of points in the discussion and select one or two to mention at this point

10.25-10.30 Final remarks and comments on procedure

16:00 – 17:00 Welcome and paper reminder presentations + reactions

 Liebendörfer, Sikko & Pepin, Stadler et al, Toor & Mgombelo, Bergster & Jablonka

17:00 – 17:30 Small group dıscussıon per paper

17:30 – 18:00 Plenary short presentatıon and dıscussıon

NB: each group much choose

– a **moderator** to ensure the discussion focus on the **paper** : raise questions, identify main points, discuss possibilities and potentials

–a **reporter** to take notes (to be given to the team at end of session) and report back orally

NB: each **author** should take notes of points in the discussion and select one or two to mention at this point

9:00 – 9:45 Welcome and paper reminder presentations + reactions

9:45 – 10:15 Small group dıscussıon per paper

10:15 – 10:30 Plenary short presentatıon and dıscussıon

NB: each group much choose

– a **moderator** to ensure the discussion focus on the **paper** : raise questions, identify main points, discuss possibilities and potentials

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In CERME7 (2011)... 20 years after:

Tall, D. (1991). *Advanced Mathematical Thinking*.

Dordrecht: Kluwer Academic Publishers.

In CERME8 (2013)… 20 years after:

- Tall, D. (1992). The transition to Advanced Mathematical Thinking: Functions, Limits, Infinity, and Proof, in D. A. Grouws (ed.), *Handbook of Research on Mathematics Teaching and Learning* (pp. 495-514), New York: MacMillan Publishing Company.

11:00 – 11:45 Welcome and paper reminder presentations + reactions

11:45 – 12:15 Small group dıscussıon per paper

12:15 – 12:30 Plenary short presentatıon and dıscussıon

NB: each group much choose

– a **moderator** to ensure the discussion focus on the **paper** : raise questions, identify main points, discuss possibilities and potentials

–a **reporter** to take notes (to be given to the team at end of session) and report back orally

NB: each **author** should take notes of points in the discussion and select one or two to mention at this point

8:30 – 9:15 Welcome and paper reminder presentations + reactions

9:15 – 9:40 Small group dıscussıon per paper

9:40– 10:00 Plenary short presentatıon and dıscussıonş preparatıon

for sessıon 7

NB: each group much choose

– a **moderator** to ensure the discussion focus on the **paper** : raise questions, identify main points, discuss possibilities and potentials

–a **reporter** to take notes (to be given to the team at end of session) and report back orally

NB: each **author** should take notes of points in the discussion and select one or two to mention at this point

Discussion of posters, 10 mins

Preparing Sunday's WG14 presentation*, 50 mins

- Group work

- Plenary discussion

Preparations for the Proceedings, 5 mins

- WG14 leader team convenes and addresses invitations to authors to revise and submit their papers for consideration for inclusion in the proceedings by February 15

- Invited authors revise and resubmit **by April 1**

- Decisions about publication in the proceedings within April

- Possible outcomes: Accept, Short Contribution, Reject

General discussion on WG structure, content and management, 10 mins

Post-conference collaboration, 15 mins

- *RME Special Issue Proposal*

- *PME37?*

- *Beyond CERME8….*

Groups (4)

- Transitions
- Affect
- teacher practices
- mathematical topics

Group work focus

- Theory
- Research paradigms
- Results
- Rigour/quality

Group work output

4 slides (max) to feed into the presentation

Plenary discussion of group-work outputs and presentation drafting

CERME 8

Thank you!

Stay in touch

See you later...

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i.biza@lboro.ac.uk ; **Alejandro González-Martin;** a.gonzalez-martin@umontreal.ca; **Ghislaine**
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Sunday Presentation

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- Mathematical reasoning and proof in university mathematics
- Challenges for teaching mathematics at university level (including the perspectives of university teachers)
- The role of ICT tools (e.g. CAS) in the teaching and learning of university mathematics
- Transition issues "at the entrance" to university studies of mathematics, or beyond
- Novel approaches to teaching Calculus and Linear Algebra
- The teaching and learning of advanced university mathematics topics (beyond Calculus and Linear Algebra)
- Challenges of teaching mathematics to students in non-mathematics degrees
- Assessing the learning and teaching of mathematics at university level
- Theoretical approaches to the study of teaching and learning mathematics at university

22 papers, organized in five themes:

Transition (secondary/university)
Affects, students' interests
Teachers practices
Mathematical topics
Mathematical domains

5 posters

Use of theory

- Bergster & Jablonka: Bourdieu (cultural capital linked to other types of capital)

- Sikko & Pepin: transition literature

- Toor & Mgombelo: syncretic (compatible?)

- Liebendörfer: SDT (Krapp)

- Stadler et al: Stadler's own triad of concepts; advanced statistics

Research paradigms

- Bergster & Jablonka : qualitative, pattern spotting

- Sikko & Pepin: quantitative / qualitative

- Toor & Mgombelo : concurrent mixed methods

- Liebendörfer: focus group interview, individual interview data, qualitative content analysis

- Stadler et al: bridging quantitative / qualitative paradigms

Results

- Bergster & Jablonka : Culture and environment influence our choice of studies ways of coping with our studies

- Sikko & Pepin : Lectures do not attend to students' needs on how they learn best Peer work is a helpful survival technique.

- Toor & Mgombelo : gender differences in self image of capability

- Liebendörfer: demonstrate capacity of SDT tool

- Stadler et al: identify several differences between beginners and more experienced students

Theoretical Frameworks

- Enculturation of mathematics / philosophy of mathematics (Hoffkamp, Schnieder & Paravicini)

- Task-design   to support Transition (Breen, O'Shea & Pfeiffer)

- Student Errors (Fardinpour & Gooya)

- ATD (Winslow)

- Curriculum-(re-)design & Multiple representation (Schmidt)

Paradigms

- Research-based development with evaluation / action research (Breen, O'Shea & Pfeiffer; Schmidt; Hoffkamp, Schnieder & Paravicini)

- Error analysis (Fardinpour & Gooya)

- Practice based development of theory (Winslow)

Results

- Non-standard tasks can facilitate students' transition (Breen, O'Shea & Pfeiffer)
- Findings from Ireland confirm int. research results on students' problems (Breen, O'Shea & Pfeiffer)
- Beginning with complex numbers/functions can improve basic skills (Schmidt)
- Being explicit and intentional about metamathematical foundations can help students' thinking about mathematics (Hoffkamp, …)
- Capstone courses assume an advanced standpoint in relevant mathematics (Winslow)
- Model captures difficulties students encounter with ODEs (Fardinpour & Gooya)

Theory

- Used:
  - Biza, Jaworski: Communities of practice and communities of enquiry
  - Pinto: Planning curriculum and implemented curriculum
  - Pinto: Decision making theory (Schoenfeld, 2011)
  - Gueudet: Resources – Documentational genesis
- Further suggestions:
  - Didactic situations
  - Teacher knowledge at university level

- Research Paradigms
  – Biza: Analytical reflective practice: reflective practitioner analyses his/her practice (insider research)

  – Jaworski: Within socio-cultural frame, developmental study in which insider and outsider researchers work collaboratively.

  – Pinto, Gueudet: Ethnographic approach including observation and reflective analysis

  – Nardi: Literature study with implications for teaching

  – Gueudet, Pinto: Case study

- Results
  - Biza: Hypothesis generating for hypothesis testing
  - Gueudet: Importance of the articulation of paper/pencil and digital resources
  - Gueudet: Evolution of the collective work linked to the digital resources
  - Jaworski: Confirmation of the integrity of the design of teaching and of the problematic nature of discerning conceptual understanding leading to a theoretical reconceptualisation
  - Pinto: The impact of the teaching experience, agenda and identity on teachers' decision
  - Nardi: Proposition of teaching intervention for PGR students in mathematics education

- Research paradigms
  - More or less the same topics as in last CERME (functions, calculus, proof, linear algebra).
  - Sfard's framework is probably evolving to develop research methodologies (Viirman, Pettersson).
  - Methodologies we wave used are really diverse.
  - Long-term studies (Alvarado, Hyvarinen, Pettersson).

- Results
  - A greater focus on teaching and predicting learning (Gonzalez-Martin, Viirman), epistemological approaches (Hausberger), constructive activities (Alvarado).
  - The focus is more on what you learn, how you learn it...

  - We would like to see more applications for teachers and want to share with teachers. Papers with mathematical notions are maybe easier to share.

Rigour / Quality

- In practitioner research, subject and object of research can be too close
- Results are dependent on the context and on the local institution
- The collection of data relies only on practitioner's reflection
- Triangulation is needed
- Collection of data from different sources is needed
- Transparency of the nature of the interpretations
- Coherence - Is our framework adequate to address our problem ?
- Combination of frameworks and coherence and not incompatibility.
- Bias when the teacher is the researcher.
- Caution in the use of statistics
- nuance, ground for apparently self evident claims
- isolating slice of data for reporting
- need to further test
- emerging results, not ready yet for dissemination?
- small sample
- convenient sampling: opportunistic? Importance of context then!
- Hypotheses have to be verified in other contexts
- Strengthen theoretical models to improve validity of results