

WG15

Technologies and resources in mathematics education

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Background

- Results and perspectives from CERME7
 - Goal: **understanding** teachers challenges rather than immediately improving teaching practices
 - **Theoretical frameworks** to analyse these challenges
 - **Instrumental approach / instrumental orchestration**
 - Emerging concepts: **double instrumental genesis**, **instrumental distance**

Background

- Results and perspectives from CERME7
 - Methodological issue
 - How to measure the effectiveness of ICT? The impact of the ICT use on students' performance, learning?
 - Exploiting the potential of “cutting-edge” technologies
 - IWB, Internet, mobile and touch devices...
 - ICT for students with special needs
 - Blind or visually impaired, dyscalculia, learning difficulties
 - Community aspects
 - Best practices, resource sharing, resource quality

CERME 8

- Call for papers - themes:
 - Design and use of technologies and resources
 - Innovative technologies (mobile, touch...)
 - ICT for learners with special needs
 - ICT and students' learning
 - Long-term studies
 - Assessment of achievements with ICT
 - Teachers' professional development
 - Communities of practice
 - Best practices in using digital resources

WG15 in a few numbers

- 44 participants from 16 countries
- 27 papers and 8 posters
 - Theme 1: 4 papers
 - Theme 2: 13 papers and 4 posters
 - Theme 3: 10 papers and 4 posters

Organization

- Altering plenary and sub-groups sessions
 - 3 plenary sessions
 - 4 sub-group sessions
- Discussion of specific topics based on paper AND poster presentations
 - ICT and conceptualisation
 - Testing and assessing with ICT
 - Software design, analysis of potential
 - Effects of ICT on students' performance
 - Theoretical issues
 - Empirical studies with ICT
 - Task design
 - Teacher professional development towards the integration of ICT

Theoretical approaches

- Variety of theoretical approaches in technology enhanced mathematics
 - Constructivism, Constructionism, Theory of Didactical Situations, Instrumental approach, Double Approach, Variation theory...
 - Need of networking theoretical frameworks, at least at the level of comparison
 - design instrumented tasks and address the contribution of different frameworks
 - address the potential of ICT offering integrated algebraic and geometrical representations
 - elaborate a model for interpreting the evolution of teachers' practices

Task design

- [ICMI study in 2013]
- For whom?
 - Students, in pre-service and in-service teacher education
- By whom?
 - teachers, researchers, teacher educators, together
- How?
 - Design principles and theoretical constructs underlying task design
- Which?
 - Potential of a task and its implementation (the role of the teacher, issues of context)

Teacher professional development

- Various dichotomies in teachers' professional development
 - Formal/informal
 - Local/global
 - Short term/long term
 - With/without ICT
- Need for a model to analyse the evolution of teachers' practices related to ICT use
- Develop and evaluate different means of professional development

Methodological issues related to evaluate effectiveness of ICT use

- How do we provide evidence of ICT to the learning and teaching?
- We need more to know about the “real” use of ICT in the classroom and outside – especially also why ICT is not used.
- It is necessary to include teachers – “common” teacher – into research.
- We need short- and longtime empirical studies, quantitative and qualitative studies concerning the effectiveness of ICT use.

Design of technologies as a research issue

- The nature of tool design in order to
 - introduce students to mathematical concepts (e.g. functions)
 - engage students in reflection on their own activities
 - facilitate mathematical communication (in the class or online).
- The role of theories in the design of technologies
- The role of symbolism and how particular mathematical ideas related to symbolism are integrated within the use of particular computational tools.
- The nature of links between algebra and geometry in computer environments offering integrated geometrical and algebraic representations

Students' learning

- What changes in students' learning?
 - Do ICT enhance students' understanding?
 - ICT contribution to the development of mental representations of math concepts (dynamic representations, multiple representations, visualisation)
- ICT supporting and changing mathematics work, communication, collaboration
- What mathematics to learn with ICT?
 - Is there any “old” mathematics which might be cancelled and some kind of “new” mathematics which might integrated into the classroom?

Assessment of students' work / problem solving activity

- Two complementary views/uses:
 - ICT tools used by students for accomplishing their work (how to assess it);
 - ICT tools used by teacher for assessing student's mathematical work (automatic or semiautomatic assessment)
- What is really assessed when tools are used for accomplishing tasks?
 - Students' learning? Students' mathematical competences? Students' technological competences? Students' solutions? Students' ways (modalities? Competencies?) of communicating the solution of a task?
- What are the purposes of assessment?
- How does the communication of solutions of tasks change when the use of ICT tools is concerned?
 - Paper and pencil: communication is part of the solution;
 - ICT: relationship between ICT solution and communication

Concerning the classroom

- How is the implementation process of ICT – concerning special topics – into the classroom?
- We need some guiding principles for the classroom work.
- We need guidelines for teachers for ICT use.
- How does ICT change the way we do mathematics (e. g. while working with multiple representations?)
- How might ICT change the classroom in the future?

Perspectives for CERME 9

- Opportunity of sharing concerns, approaches, issues
- Needs:
 - Common understanding of terms, vocabulary
 - Joint work on concrete material (task, ICT tool, data) from different perspectives
 - Non digital technologies (textbooks, web resources)
 - International comparative studies

HOW TO CAPITALIZE RESEARCH OUTCOMES?