

CERME 6 – GENERAL INTRODUCTION

INTRODUCTION TO CERME 6

BY BARBARA JAWORSKI PRESIDENT OF ERME EUROPEAN SOCIETY FOR RESEARCH IN MATHEMATICS EDUCATION

CERME is the two-yearly congress of ERME, the European Society for Research in Mathematics Education. CERME 6 marks more than a decade of ERME and it is important to recognise the achievements of the society over this time.

In May 1997, a group of 16 scholars from different European countries met in Osnabrück, Germany, for three days to discuss the formation of a European society in mathematics education. In true European spirit, we decided that we wanted a society which would bring together researchers from across Europe, particularly including colleagues from Eastern Europe, fostering *communication, cooperation* and *collaboration*. We wanted a conference that would explicitly provide such opportunity. We wanted especially to encourage and contribute to the education of young researchers. Thus ERME was born and began to take shape.

We decided on a two-yearly conference, or *congress* as it later became known, and the name CERME emerged – Congress of the European Society for Research in Mathematics Education. CERME should have a group structure in which researchers would have sufficient time to really get to know each other, share and discuss their research and engage in deep scholarly debate. The first CERME was planned for February 1999, at Osnabrück. The Program Committee took very seriously the aims for the conference expressed at the 1997 meeting. Seven working groups were planned and 12 hours were provided for work in a group. To avoid most of the conference time being taken up by paper presentation, it was decided there would be no oral presentations at the conference. Papers would be presented in written form before the conference with sufficient time for group participants to read the papers. The 12 hours would be spent discussing the papers and working on themes and issues suggested by the papers and the group leaders. Over the succeeding years, a group led by Konrad Krainer (Austria) and Paolo Boero (Italy) developed a plan and style for a YERME summer school (YESS). The first summer school was held in Klagenfurt, Austria in August 2002. Like CERME, the summer school was based around groups, working on papers submitted by the young researchers, each with an international “expert” as leader.

The pattern of CERME and YERME has developed so they take place in alternative years, the group structure being developed and carried forwards from one to the next. We had CERME 2 in Mariánské Lázně, Czech Republic in 2001; CERME 3 in Bellaria, Italy in 2003; and YESS 2 in Pödebrady, Czech Republic in 2004. CERME 4 took place in Saint Feliu, Spain in February, 2005 and YESS 3 in Jyväskylä, Finland in August 2006. CERME 5 was held in Cyprus in February 2007, and YESS

4 in Trabzon, Turkey in August, 2008. CERME 6 will take place in Lyon, France in 2009 and YESS 5 in Palermo, Italy in 2010. People came from these events speaking of *inspirational* experiences. It seemed clear that the events generated something that we came to call *the CERME Spirit*. Based fundamentally on the three Cs, communication, cooperation and collaboration, the CERME Spirit was about the inspiration that derives from serious scholarly tackling of ideas and concepts in key areas and of mathematics education research with colleagues from multiple nations, facilitated by the group design of the events.

However, the group design was not without its critics. Some critics felt constrained by the requirement to spend a conference, largely, in just one group. Some felt that a conference ought to offer a greater variety of opportunity to participants. Participants should be free to choose where to be at any time. However, the group work at CERME or YESS would be seriously disrupted if participants were to hop from group to group, not engaging seriously with the work in any one. Some suggested that perhaps planning could allow participants to take part in two groups, so that engagement in both could be serious. Such ideas have been considered by the ERME Board and Programme Committees but so far we have remained faithful to the initial conception. Many participants have said in evaluation of the events that the opportunity to spend serious time in one group allowed them to really get to know researchers from other countries, and that this contributed significantly to the depth of thinking that was possible.

We want to encourage wider participation to ongoing activity in our Society, with more nations contributing to hosting events and a secure financial platform for continuing our inclusive communication, cooperation and collaboration within Europe. Further details of ERME can be found at the following site: <http://ermeweb.free.fr/>

Barbara Jaworski – President of ERME

PRESENTATION OF CERME 6 BY FERDINANDO ARZARELLO, CHAIR OF THE SCIENTIFIC INTERNATIONAL COMMITTEE

As pointed out in the document written by our President, CERME is a Congress designed to foster a communicative spirit in European mathematics education according to the three Cs of ERME: communication, cooperation and collaboration. It deliberately moves away from research presentations by individuals towards collaborative group work. Its main feature is a number (15) of thematic groups whose members have worked together in a common research area.

In addition to the working group sessions, there was:

- Two plenary lectures and a panel;
- Two parallel 1 hour sessions where the participants had the opportunity of debating with the plenarists;
- A poster session;
- Final parallel sessions (repeated twice), where each group has presented its work to the interested participants;
- Policy and purpose sessions to negotiate the work and directions of ERME.

The philosophy of our Congress is based on the following two issues:

- i. We need to know more about the research which has been done and is ongoing, and the research groups and research interests in different European countries;
- ii. We need to provide opportunities for cooperation in research areas and for inter-European collaboration between researchers in joint research projects.

In organising this Conference we considered both the ERME spirit and the observations from the questionnaires filled by the participants, which mainly concerned the plenary events. Consequently, the following structure was planned:

- Two plenary lectures of 75 minutes; each plenarist had a reactor: they had 60 minutes for their two presentations, and then there was 15 minutes for questions from the floor. Moreover the interested people had the opportunity to meet the plenarists in an informal meeting in another day.
- An other event is the special 2 hour plenary of the last day, which had three participants: the aim was to discuss a topic emerging from previous CERMEs,

analysing it from different standpoints and to give people the possibility of a wide debate.

The structure of the Working Groups was essentially the same: each group had more of 12 hours for discussing its topic. In the final Sunday session each group have presented the results of its work in two consecutive one hour slots, according to the model experienced in CERME 5, which had received the approval of the participants.

I think that all of us had a very exciting week, plenty of interesting scientific and social opportunities. In particular I underline the lecture of Prof. E. Ghys — <http://www.dimensions-math.org> — and the discussion on a Project of a European Journal of Mathematical Education.

I wish to thank the local organisers, and particularly Viviane Durand-Guerrier, for the enormous work they have done to make possible the realisation of this Conference.

Ferdinando Arzarello – Chair of the scientific international committee

QUALITY AND INCLUSION IN CERME 6: A PROPOSED REVIEW

The European Society for Research in Mathematics Education (ERME), and its principal activities CERME (2-yearly Congress of ERME) and YERME (meetings of Young researchers in ERME) are committed to the three Cs: *Communication*, *Cooperation* and *Collaboration* in research in mathematics education. Over the years in which ERME has existed, the community has developed what has become known as “*The CERME Spirit*”. These words capture a practical manifestation of the objectives expressed in the three Cs. The phrase refers to an *inclusivity* of working in which people genuinely work together, in which all are welcome, and in which members work hard to ensure that all can take a full part in activity. A major factor and issue – that of the language of our work – has been addressed seriously; different groups devising their own approaches to their working language.

However, these things are not straightforward and issues arise as soon as we construct practical situations. The main example of this concerns the scientific quality of our work in mathematics education research. Of course we aspire to a high quality of scientific work, just as we aspire to operate in fully inclusive ways. Ideally we should like there to be compatibility between the two. But what does or can this look like in practice?

These issues face group leaders as soon as they set out to construct a programme of work for their group, starting with a call for papers. Responding to this call, we see that many papers are now received for all groups. This suggests that researchers in our field want to be part of CERME and offer their work to colleagues in CERME. From an inclusive point of view, all papers should be welcome and all those wishing to participate should have a place. However, from a scientific point of view, papers should be reviewed according to scientific criteria, those that are of a suitable scientific quality (according to the group leaders) should be accepted and others rejected. In practice this means that authors of rejected papers may not be able to attend the congress since funding depends on an accepted paper. The practice seems to go against principles of inclusion.

The ERME Board, and Programme Committees of CERME conferences have been aware of these issues and have addressed them by creating a two stage review process. For presentation of papers at the congress, a much more open attitude should be taken to the criteria, aiming to include as many participants as possible. At this stage, feedback to prospective participants should detail what is required for a paper to be acceptable for the scientific proceedings following the congress. Papers not meeting these requirements would not be accepted for the proceedings. Of course, it is then up to the group leaders to determine how to make the necessary decisions: what is acceptable for presentation, and what are the more strict criteria for publication? They also have to decide how to conduct the work of the group in an

inclusive way. Similarly those organising YERME events have to decide how to ensure both quality and inclusion in practice.

Our sixth CERME achieved, it therefore feels like a time to review these issues and procedures. For this purpose, a small group of interested members of ERME has agreed to survey participants in CERME 6 and seek views on the processes and issues that are involved. We have included an opportunity to comment in the evaluation questionnaire for CERME 6 and possibility to send us a personal communication (written) to express your views in more detail. We have also asked group leaders, present and past, to tell us how they have made decisions and what difficulties if any there have been.

As a result of analysing the information received we hope to write a paper for a scientific edited book on the topic of inclusion and quality. Such a paper could also act as a basis for future policy in ERME, CERME and YERME.

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Ferdinando Arzarello
M. Alessandra Marriotti
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SCIENTIFIC PROGRAM

CERME 6 PLENARY CONFERENCES

Jan 28, 15:30 - 16:45

Luis Radford, Université Laurentienne, Ontario, Canada.

SIGNS, GESTURES, MEANINGS: ALGEBRAIC THINKING FROM A CULTURAL SEMIOTIC PERSPECTIVE.

Reactor: Heinz Steinbring (Duisburg-Essen University)

Summary. In this presentation I will deal with the ontogenesis of algebraic thinking. Drawing on a cultural semiotic perspective, informed by current anthropological and embodied theories of knowing and learning, in the first part of my talk I will comment on the shortcomings of traditional mental approaches to cognition. In tune with contemporary research in neuroscience, cultural psychology, and semiotics, I will contend that we are better off conceiving of thinking as a sensuous and sign-mediated activity embodied in the corporeality of actions, gestures, and artifacts. In the second part of my talk, I will argue that algebraic thinking can be characterized in accordance with the semiotic means to which the students resort in order to express and deal with algebraic generality. I will draw upon results obtained in the course of a 10-year longitudinal classroom research project to offer examples of students' forms of algebraic thinking. Two of the most elementary forms of algebraic thinking identified in our research are characterized by their contextual and embodied nature; they rely extensively upon rhythm and perceptual and deictic (linguistic and gestural) mechanisms of meaning production. Furthermore, keeping in line with the situated nature of the students' mathematical experience, signs here usually designate their objects in an indexical manner. These elementary forms of algebraic thinking differ from the traditional one—based on the standard alphanumeric symbolism—in that the latter relies on sign distinctions of a morphological kind. Here signs cease to designate objects in the usual indexical sense to give rise to symbolic processes of recognition and manipulation governed by sign shape.

The aforementioned conception of thinking in general and the ensuing distinction of forms of algebraic thinking shed some light on the kind of abstraction that is entailed by the use of standard algebraic symbolism. They intimate some of the conceptual shifts that the students have to make in order to gain fluency in a cultural sophisticated form of mathematical thinking. Voice, gesture, and rhythm fade away. Embodied and contextual ways of signifying are then replaced with a perceptual activity where differences and similarities are a matter of morphology, and where meaning becomes relational.

Jan 29, 9:15 - 10:30

Paola Valero, Aalborg University, Denmark.

ATTENDING TO SOCIAL CHANGES IN EUROPE: CHALLENGES FOR MATHEMATICS EDUCATION RESEARCH IN THE 21ST CENTURY

Reactor: Margarida Alexandra da Piedade Silva Cesar (Lisbon University)

Summary. Based on an analysis of mathematics education research as an academic field and on current social, political and economic transformations in many European countries, I would argue for the need to rethink and enlarge definitions and views of mathematics education as a scientific field of study in order to provide better understandings and alternatives for practice in the teaching and learning of mathematics today. I will explore the notion of the “network of mathematics education practices” as a complex, multi-layered space of social practice where the meanings of the teaching and learning of mathematics are constituted. I will illustrate the potentiality of this notion to envision possible research paths in the field. I will illustrate these with the research that my colleagues and I have been carrying on multicultural classrooms in Denmark; as well as will offer examples of other research studies in Europe and other parts of the world where I see that the discipline is gaining newer insights that could allow attending to the social changes and challenges of the 21st century.

Feb 1st, 11:00 – 13:00

SPECIAL PLENARY: WAYS OF WORKING WITH DIFFERENT THEORETICAL APPROACHES IN MATHEMATICS EDUCATION RESEARCH

Speakers: **Angelika Bikner-Ahsbabs, Bremen University, Germany**

John Monaghan, University of Leeds, United Kingdom

Chair: **Tommy Dreyfus, Tel Aviv University, Israel**

Structure : This plenary activity is planned to last 2 hours and will comprise five parts

Introduction (T. Dreyfus, 5 min)

Networking of theories – why and how? (A. Bikner-Ahsbabs, 25 min + 5 min for clarifications)

Taking the appropriate parts from a variety of theories (J. Monaghan, 25 min + 5 min for clarifications)

Questions to the floor (T. Dreyfus, 10 min)

Questions and contributions from the audience with reactions from the speakers (45 min)

Background. The development and elaboration of theoretical constructs that allow research in mathematics education to progress has long been a focus of mathematics education researchers in Europe. This focus has found its expression in many CERME working groups: some are focused around a specific theoretical approach and others allow researchers from different theoretical traditions and backgrounds to meet and discuss. More specifically, relationships between theories have been made the explicit focus of attention of the theory working group that started at CERME 4 in 2005. The present plenary activity inserts itself in this line of work of CERME, and aims to broaden the discussion about relationships between theories to include members of all CERME working groups.

Abstract by Angelika Bikner-Ahsbals: Networking of theories – why and how? Research in mathematics education addresses teaching and learning of mathematics in a wide sense. For example, theories about learning fractions may tell a lot of different things about learning fractions. Some of them are about mistakes and why some mistakes are stable. Others may tell us about how students can be motivated to learn fractions. There are theories about how fraction concepts can be built best, which students' imaginations accompany learning fractions and what abstraction processes can be observed. In addition, we have to distinguish between theories for gifted students and theories for students with special needs, etc.

These considerations already show that research objects within mathematics education are complex. This complexity has led to a large variety of theoretical approaches. Every successful new theoretical view broadens or deepens insight in a phenomenon, hence, enriches our knowledge about the phenomenon. Therefore, it seems necessary to regard the large diversity of theories as richness. However, the rich diversity of theoretical approaches engenders problems of understanding and communicating. Sometimes we find the same terms meaning different things, for example the different concepts of abstraction, mathematising and constructing. However, we also find different words for the same or similar meanings, for example reification and constructing can both mean building a new knowledge entity.

Hence, a large diversity of theories can be regarded as richness but it also causes difficulties for researchers to understand each other and for teachers and teacher trainers to make use of research results in an adequate way. These problems raise the following questions: How could researchers gainfully frame the use of the diversity of theoretical approaches? What kind of benefit can be gained through such frames? How can theories be made more useful for practitioners?

In the plenary talk, networking of theories is proposed to be a fruitful approach to frame the diversity of theories or theoretical approaches. It has been practiced and reflected on since 2005 (CERME4) within a group of researchers networking their theories. This work has already shown that networking of theories means more than creating a consistent frame to investigate a research question it is a systematic way of theory development. In the plenary talk, an example is used to clarify the meaning

and to describe some benefit of it for the research and the practice of teaching and learning mathematics.

Abstract by John Monaghan: Taking the appropriate parts from a variety of theories.

I will argue the case for ‘taking the appropriate parts from a variety of theories according to needs of the research’ rather than trying to ‘merge theories’. One part of my argument is who I and, if I may extend this, who most CERME participants are – working mathematics education researchers. Mathematics education research is demanding and does not (except for a few gifted individuals) allow researchers to become specialist philosophers, psychologists and /or sociologists; but we may find it useful to use the ideas of philosophers, psychologists and /or sociologists. Another part of my argument will concern theoretical frameworks within mathematics education and I will argue for caution with regard to attempts to merge such theories. These theories have, in general, distinct historical roots, developed in academic communities which have appropriated constructs in specific ways and the ‘grain sizes’ of their analyses often differ. Attempting to merge whole theories, as opposed to appropriating constructs, comes with a real danger of creating an ill-formed hybrid.

So will I argue that mathematics education researchers should ‘pick a little bit from this theory and a little bit from that theory’? Well, yes, I will ... but with caution! I will argue that the ‘bits we pick’ depend on the situation, the specific focus of the research in which we are engaged, and the consistency of ‘bits we pick’.

I have avoided referring to specific theories in this abstract but I will detail theories in my talk and I will also use research studies as cases to exemplify my arguments.

WORKING GROUPS

15 working groups: 7 sessions, 1 or 2 per day, duration 1h30 or 2h

Final group reports: Sunday Feb 1st, 8:30 - 10:30

Poster Session: Thursday Jan. 29 17:15 - 18:30

N.B. The posters remain during the all congress in the hall of the THEMIS. During the poster session, the authors were present.

Group 1: Affect and mathematical thinking - This includes the role of beliefs, emotions, and other affective factors

Markku Hannula, Finland (Chair); Tine Wedege, Norway; Marilena Pantziara, Cyprus.

Group 2: Argumentation and proof - This includes epistemological and historical studies, learning issues and classroom situations

Maria Alessandra Mariotti, Italy (Chair); Patrick Gibel, France; Leonor Camargo, Colombia; Kristina Reiss, Germany.

Group 3: Stochastic thinking - This includes epistemological and educational issues, pupils cognitive processes and difficulties, and curriculum issues

Andreas Eichler, Germany (Chair); Maria Gabriella Ottaviani, Italy; Dave Pratt, United Kingdom; Floriane Wozniak, France.

Group 4: Algebraic thinking - This includes epistemological and educational issues, pupils cognitive processes and difficulties, and curriculum issues

Chair: Giorgio Bagni, Italy (Chair); Janet Ainley, United Kingdom; Lisa Hefendehl-Hebeker, Germany; Jean-Baptiste Lagrange, France.

Group 5: Geometrical thinking - This includes epistemological and educational issues, pupils cognitive processes and difficulties, and curriculum issues

Alain Kuzniak, France (Chair); Iliada Elia, Cyprus; Mathias Hattermann Germany; Filip Roubicek, Czech Republic.

Group 6: Mathematics and language - This includes semiotics and communication in classrooms, social processes in learning and teaching mathematics

Candia Morgan, United Kingdom (Chair); Marie-Thérèse Farrugia (Malta); Marei Fetzer (Germany); Alain Mercier, France.

Group 7: Technologies and resources in mathematical education - This includes teaching and learning environments

Ghislaine Gueudet, France (Chair); Rosa Maria Bottino, Italy; Stephen Hegedus, United States of America; Hans-Georg Weigand, Germany.

Group 8: Cultural diversity and mathematics education - This includes students' diverse backgrounds and identities, social and cultural processes involved, political issues in the educational and school policies.

Chair: Guida de Abreu, United Kingdom (Chair); Nuria Gorgorio, Spain; Sarah Crafter, United Kingdom.

Group 9: Different theoretical perspectives / approaches in research in mathematics education - This includes ways of linking theory and practice and paradigms of research in ME.

Susanne Prediger, Germany (Chair); Marianna Bosch, Spain; Ivy Kidron, Israel; John Monaghan, United Kingdom; Gérard Sensevy, France.

Group 10: From a study of teaching practices to issues in teacher education - This includes teachers' beliefs and the role of the teacher in the classroom, as well as strategies for teacher education and links between: theory and practice, research and teaching and teacher education, collaborative research.

Chair: Leonor Santos (Portugal) José Carrillo, Spain; Alena Hospesova, Czech Republic; Maha Abboud-Blanchard, France.

Group 11: Applications and modelling - This includes theoretical and empirical-based reflections on: the modelling process and necessary competencies, adequate applications and modelling examples, epistemological and curricular aspects, beliefs and attitudes, assessment and the role of technology.

Morten Blomhøj, Denmark (Chair); Susana Carreira, Portugal; Katja Maass, Germany; Geoff Wake, United Kingdom.

Group 12: Advanced mathematical thinking - This includes conceptual attainment, proof techniques, problem-solving, processes of abstraction, at the upper secondary and tertiary educational level.

Roza Leikin, Israel (Chair); Claire Cazes, France; Joanna Mamona-Downs, Greece; Paul Vanderlind, Sweden.

Group 13: Comparative Studies in Mathematics Education - It includes questions surrounding mathematics teaching and learning in the classroom, learners' and teachers' experiences and identities, and policy issues in different cultures and/or countries.

Eva Jablonka, Sweden (Chair); Paul Andrews, United Kingdom; Birgit Pepin, United Kingdom; Pasi Reinikainen, Finland.

Group 14: Early Years Mathematics . This Working Group deals with the research domain of mathematics learning and mathematics education in the early years, age 3 to 7- In the last decades the interest in this topic has increased immensely.

Götz Krummheuer, Germany (Chair); Patti Barber, United Kingdom; Demetra Pitta-Pantazi, Cyprus; Ewa Swoboda, Poland.

Group 15: Theory and research on the role of history in Mathematics Education - The integration of history of mathematics in mathematics education is a subject which has received increasing attention during the last decades.

Chair: Fulvia Furinghetti , Italy (Chair); Jean-Luc Dorier, France; Uffe Thomas Jankvist, Denmark; Costantinos Tzanakis, Greece.

YERME - YOUNG ERME

YERME is an organization aiming at creating collaboration and mutual support among young researchers of different countries in the field of mathematics education. The two main activities of YERME are:

1. YESS – YERME Summer Schools

The aims of the Summer Schools are:

- To let people from different countries meet and establish a friendly and cooperative style of work in mathematics education research;
- To let people compare and integrate their preparation in mathematics education research in a peer discussion climate with the help of highly qualified and differently oriented experts;
- To let people present their research ideas, theoretical difficulties, methodological problems, and preliminary research results, in order to get suggestions (from other participants and experts) about possible developments, different perspectives, etc. and open the way to possible connections with nearby research projects and co-operation with researchers in other countries.

YESS1 took place in Klagenfurt, Austria, 2002; YESS2 at Podebrady, Czech Republic, 2004; YESS3 at Jyväskylä, Finland, 2006 and YESS4 at Trabzon, Turkey, 2008.

YESS5 will take place in Italy (August 2010). Ph.D., Master and post-graduate students and other people entering Mathematics Education research are invited to take part in YESS summer schools.

2. YERME day

The YERME-day takes place the day before CERME. The spirit is the same as YESS. Young European researchers take part in Discussion Groups and Working Groups. The topics of these groups are close to young researchers' interests. This kind of organization allows European students to meet and start to build links between different countries. They also have the opportunity to work with experts in the research education field. The program of the YERME-Day 2009 (January, 27th and 28th) is available on the YERME Website <http://yerme.eu> .