

**INTRODUCTION TO THE PAPERS OF WG 17:
FROM A STUDY OF TEACHING PRACTICES TO ISSUES IN
TEACHER EDUCATION¹**

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Overview: There was recognition of the value and complementarities of different approaches to the professional development of teachers. However, it was also recognised that there are constraints and affordances for different approaches, which vary between cultural contexts. Working across cultures on teacher development projects, which employ different strategies, was considered to be a useful way of moving forward our understanding of different approaches. There were some attempts to synergise different frameworks in research and development activities that were reported in the papers. However, there remains considerable work to be done in understanding how different frameworks relate to one another and in supporting researchers in selecting elements of different frameworks that will enable them to answer specific research questions.

Group 17 received 57 proposals (48 for papers and 9 for posters), which involved 129 authors from 28 nationalities. Each paper was reviewed by one of the group leaders and two authors. For most proposals we asked for some revisions. In the sessions of the working group during the conference, 37 papers and 8 posters were presented.

According to what had been proposed in CERME 6, the working group split into two subgroups (WG17 A and WG17 B). The group was all together for only the first part of session one and for the last session. All the papers were grouped into seven topics and distributed to the two subgroups. All the participants were informed in advance of the distribution of the papers in the two subgroups.

All participants of WG17 were expected to have read papers previously to the session in which they were presented. In each session, three or four authors sketched the key ideas of their report (5 minutes each). One of the group leaders or participants then gave a prepared reaction to the set of papers (10 minutes). In most cases, the reactor attempted to make links between the papers and suggested questions arising from the papers that might form the basis for discussion.

The organisation of the sessions was highly rated by the participants, as was the atmosphere. Nevertheless, at the final session, the group coordinator presented several possible scenarios to organize the working group for the future, given that participation remains high. Although no decision has been taken, a general opinion was voiced against the possibility of splitting this working group into two new ones.

⁸⁴ Alena Hočpesová (Czech Republic) contributed as a group leaders, being in charge of part of the review process.

Topics

We present the issues and ideas that emerged in reference to seven central topics.

Topic I: Mathematical content knowledge for teaching

The categorisation of knowledge needed for the teaching of mathematics and how such knowledge might be identified in the practice of, or when discussing teaching underpinned many of the papers discussed in WG 17A. Ball et al's 'egg' appeared to be generally accepted as a useful framework for categorising knowledge and Rowland et al's Knowledge Quartet was frequently used as a means for identifying the situations in which such knowledge was revealed in the practice of teaching. This common language and understanding of frameworks represented a clear progression from the discussion in CERME 6.

Topic II: Professional knowledge for teaching

The papers discussed referred to a number of different approaches to the development of mathematics teaching through both Initial Teacher Education (ITE) and Continuing Professional Development (CPD). Although supporting learning in knowledge about mathematics and mathematics pedagogy was seen as the foundation for developing mathematics teaching, it was recognised that it was developing the application of this knowledge in action (knowing how to) that should be our ultimate developmental and research concern. The balance between focusing on the development of knowledge about and the development of knowing how to was considered in relation to how this varies between ITE and CPD.

Topic III: Reflection in mathematics teachers' professional development

One approach that seemed to be effective was the use of theoretical concepts and frameworks by the teachers in discussing and analysing mathematics teaching. Although teachers' interpretations of these concepts and frameworks and the way they link them to teaching are often idiosyncratic, the studies indicate that this approach promotes critical reflection of teachers' beliefs, knowledge and practices. Another issue that emerged was that teachers' reflection on a number of mathematical, teaching and learning phenomena can improve both their mathematics and pedagogical content knowledge. Finally, mathematics educator's learning from teachers' reflection is also an important issue that needs further research attention.

Topic IV: Collaboration in mathematics teachers' professional development

Within teachers' professional development the modes of collaboration between the different actors are of crucial importance for achieving successful development. The three papers related to this topic present different models concerning the collaboration between teachers and didacticians, teachers with colleagues, and teacher students and teacher educators. These studies share a willingness of considering teachers, colleagues, or teacher students as true partners in the process of change, and this seems to be one of the principles of professional development. However, issues related to sustainability of such collaborative models need to be critically addressed and carefully investigated in future.

Topic V: Professional development

A significant discussion in the working group concerned the long-term effectiveness of professional development programmes, in particular related to mathematics teacher education. It is necessary to understand, in a deep way, the characteristics of professional development for sustainable impact. Is it really possible to know what is the impact after some years? What does sustainability mean in a society where people change profession?

The working group also discussed whether there are different issues concerning preservice and in-service teachers education programmes.

Topic VI: Conceptions and practices

The papers presented in this session concern mainly the study of particular aspects of teachers' practice, highlighting the relationships between teachers' beliefs, knowledge, didactical and methodological choices and students' learning.

Two studies are devoted to the analysis of teachers' work in their daily practice, with the aim of collecting data useful to find ways to improve teacher training and show the incidence of the teacher's beliefs in management of their class work. Another paper focused on collaborative curriculum management in the context of a school mathematics department focusing on sustainability of the culture. This contrasted with a study involving prospective teachers, evidencing trainees' difficulties in theoretical and methodological analysis, given their lack of teaching experiences and the short length of their course. The personal dimension seems to have a real influence, including negatively, documented by a study involving teachers who, convinced that metacognitive activities can be practised exclusively with more gifted students, were negatively influenced in their teaching by this belief.

Topic VII: Interaction in the classroom

The four papers were in the frame of teachers' educational projects centered on laboratories devoted to classroom practice either in pre-service or in service education. In general terms, these projects are aimed at developing the teachers' ability to enact generative teaching, to refine their communicative practices (posing questions, listening and answering) to control the cognitive implications of their behaviors and to assess the students' mathematical learning. Even if framed in different theoretical studies, all the research projects are realized over the long term (at least one year), through collaborative work between teachers and mentors/researchers.

PAPERS

WG17A

Topic I: Mathematical content knowledge for teaching

Bednarz, N. & Proulx, J. *An attempt at defining teachers' mathematics through research on mathematics at work.*

Davis, S. *The Impact of teaching mental calculation strategies to primary PGCE students.*

Fernández, S.; Figueiras, L.; Deulofeu, J. & Martínez, M. *Re-defining HCK to approach transition.*

Ineson, G. *The use of the empty number line to develop a programme of mental mathematics for primary trainee teachers.*

Kaldrimidou, M.; Haralambos, S. & Tzekaki, M. *Readings of the mathematical meaning shaped in the classroom: exploiting socio-cultural and instructional lenses.*

Kleve, B. *Literacy in mathematics – a challenge for teachers in their work with pupils.*

Ribeiro, C. M. & Carrillo, J. *Knowing mathematics as a teacher.*

Tichá, M. & Hočpesová, A. *Teacher competences prerequisite to natural differentiation.*

Tutak, F. *Pre-service elementary teachers' Geometry content knowledge in methods course.*

Topic II: Professional knowledge for teaching

Kilic, H. *The nature of preservice teachers' pedagogical content knowledge.*

Kuntze *et al.* *Professional knowledge related to Big Ideas in Mathematics – an empirical study with pre-service teachers.*

Rowland, T.; Jared, L. & Thwaites, A. *Secondary mathematics teachers' content knowledge: the case of Heidi.*

Turner, F. *Differences in the Propositional knowledge and the knowledge in practice of beginning primary school teachers.*

Topic III: Approaching reflection in mathematics teachers' professional development

Liston, M. & Gill, O. *The role of video-based experiences in the teacher education of pre-service mathematics teachers.*

Potari *et al.* *Prospective mathematics teachers' noticing of classroom practice through critical events.*

Sánchez, M. *Concepts from mathematics education research as a trigger for mathematics teachers' reflections.*

Topic IV: Approaching collaboration in mathematics teachers' professional development

Berg, C. *Adopting an Inquiry approach to teaching practice: the case of a primary school teacher.*

Gunnarsdóttir, G. & Pálsdóttir, G. *Lesson study in Teacher Education: a tool to establish a learning community.*

Mgombelo, J. & Jamani-Jaipal, K. *Mathematics problem solving professional learning through collaborative action research.*

WG17B

Topic V: Professional development

Asami-Johansson, Y. *A study of problem solving oriented lesson structure in mathematics in Japan.*

Back, J. & Joubert, M. *Lesson study as a process for professional development: working with teachers to effect significant and sustained changes in practice.*

Canavarro, A. P. & Patrício, M. *Mathematical investigations in the classroom: a context for the development of professional knowledge of mathematics teachers.*

Corcoran, D. *The need to make "boundary objects" meaningful: a learning outcome from lesson study research.*

Koleza, E.; Markopolous, C. & Nika, S. *Helping in-service teachers analyze and construct mathematical tasks according to their cognitive demand.*

Matins, C. & Santos, L. *Planning teaching activity within a continuous training program.*

Regecová, M. & Slavíková, M. *Curricular changes in preparation of future teachers – financial mathematics course.*

Rubio *et al.* *Preservice teachers learning to assess mathematical competencies.*

Zehetmeier, S. & Kraine, K. *Effective ways of promoting in-service mathematics teachers' professional development.*

Topic VI: Conceptions and practices

Arditi, S. *Primary school ordinary teachers using a same manual written by didactic practices' variability.*

Choquet, C. *Why do some french teachers propose to their pupils «problèmes ouverts» in mathematics in primary school?*

Cusi, A. & Malara, N. *Analysis of the teacher's role in an approach to algebra as a tool for thinking: problems pointed out during laboratorial activities with perspective teachers.*

Nowieska, E. *A study concerning the differences between the surface and deep structure of Math lessons.*

Nunes, C. & Ponte, J. *Teachers managing the curriculum in the context of the mathematics' subject group.*

Topic VII: Interaction in the classroom

Guerreiro, A. & Serrazina, L. *Conceptions and practices of mathematical communication.*

Malara, N. & Navarra, G. *Multicommented transcripts methodology as an educational tool for teachers involved in constructive didactical projects in early Algebra.*

Martignone, F. *Laboratory activities in teacher training.*

Tomás Ferreira, R. *Moving beyond an evaluative teaching mode: the case of Diana.*

POSTERS

Bommel, J. *How to teach mathematical knowledge for teaching.*

Ceia, M. *Analysing exams mathematical questions.*

Fransman, J., Mgombelo, J. & Van der Walt, M. *The practices of prospective teachers in South African and Canadian mathematical literacy teacher education programs: What works and what does not?*

Rocha, H. Teachers' use of graphing calculators in high school mathematics classroom - the influence of teachers' professional knowledge.

Spencer, P. & Edwards, J. *Deeper mathematical understanding through teacher and teaching assistant collaboration.*

Vanegas, Y., Giménez, J. & Font, V. *Didactical analysis and citizenship with prospective mathematics teachers.*