



I C M E
1 0
2 0 0 4

TSG

Topic Study
Group 23

TSG 23: Education, professional life and development of mathematics teachers

Team Chairs: *Milan Hejny*, Charles University of Prague, The Czech Republic
*Barbara Jaworski*¹, Agder University College, Kristiansand, Norway
Team Members: *Sandy Dawson*, Pacific Resources for Education and Learning, Honolulu, USA
Li, Shiqi, East China Normal University, Shanghai, P.R. China

Introduction

TSG 23 addressed both theory and practice in mathematics teacher education and teaching development. The organisers' main focus for the group was: The nature of being and of developing as a mathematics teacher or teacher educator.

27 papers were submitted to the group. All were reviewed by three reviewers. 20 papers were accepted. These were posted on the ICME-10 website for reading before the conference. A list can be found at the end of each section of this report. There were no oral presentations in the group in order to give as much time as possible to a consideration of concepts and issues. Papers were grouped according to four themes, based on questions related to the main focus of the group. Thinking of ourselves as mathematics teachers and/or educators we asked:

- How do we use collaborative processes in learning and teaching to enable effective learning experiences for students and teachers?
- How do we create or facilitate the learning of mathematics in our teacher education programmes and relate this to mathematical learning in classrooms?
- How can we relate understandings of mathematics with understandings of pedagogy to create effective didactic situations in classrooms?
- How do our theories and beliefs influence our work as teachers with pupils or our work as educators with teachers?

Four eminent scholars in the field, *Terry Wood*, *Romulo Lins*, *Jeppe Skott*, and *Tom Cooney*, were invited to respond to papers on each of these themes respectively. They were asked to read and comment on a set of papers and to raise critical questions and issues related to the papers for discussion in one group session. The plan for each of the working sessions was as follows:

- Brief introduction by one or two group leaders, setting up the focus for the session.
- Oral presentation by one respondent: an account of the ideas and issues raised by the set of papers; offering a critical response and raising questions for discussion.
- Discussion among participants, either in small groups or in plenary. Guidance for discussion to be provided by the group leaders.
- Brief synthesis, by the group leader, of the discussion in the session.
- Last session only: Summing up ideas from the four sessions.

1 In 2007 Barbara Jaworski's affiliation changed to the University of Loughborough, UK

We present now key elements from the presentations of the four respondents. Each respondent offered critical responses to each of five papers, but we do not have enough space here to include the detail of these responses.

Theme 1: What is the difference between collaboration and cooperative process in learning? Terry Wood's response

Forms of working together are defined as:

- a) co-operative forms of interaction in which participants communicate about and share their work but do not develop ideas together, and
- b) collaborative forms of interaction in which the work is the joint product of the participants.

Examined empirically these *collaborative inquiry approaches* are found to engage students in acquiring mathematical practices such as reasoning, representing and communicating and support the development of their conceptual understanding.

Teaching practices that enable effective collaborative learning experiences for students observe that

- the environment or culture of class matters and the teacher plays the major role in establishing and determining what this environment will be.
- tasks matter--they must be mathematically challenging, open-ended or problem-solving in order for students to have a need to collaborate.

A central premise drawn from papers is: Teachers at all levels of development (e.g., beginning; experienced), teacher educators and researchers work collaboratively to investigate, examine, revise and record their experiences to develop a shared knowledge base for mathematics teaching as a way to develop competencies.

Theme 1 papers:

Fiorentini, Dario; Freitas, M.T.M.; Miskulin, R.G. et al (Brazil): "Brazilian research on collaborative groups of mathematics teachers"

Barbara Georgiadou, Christos Markopoulos, Despina Potari and Vassiliki Spiliotopoulou (Greece): "Teachers' and researchers' collaboration: the development of common goals"

Alena Hošpesová and Marie Tichá (The Czech Republic): "Learn to teach via collective reflection"

Jana Kratochvílová (The Czech Republic): "Educator–teacher interaction(fragment of a case study)"

Will Morony (Australia): "Teacher defined professional standards as a blueprint for professionalism in the work of teachers of maths"

Theme 2: How do we create or facilitate the learning of mathematics in our teacher education programmes and relate this to mathematical learning in the classrooms? Romulo Lins' response

First, it seems that the approaches suggested by the papers are guided primarily by assumptions (theoretical or not, implicit or explicit) about the learning of future teachers and by studies on what seems to be the qualities or competencies of a good teacher, apparently not taking a great interest in how this education is 'transposed' to the actual



I C M E
1 0
2 0 0 4

TSG

Topic Study
Group 23



I C M E
1 0
2 0 0 4

TSG

Topic Study
Group 23

professional practice. Let me clarify this. I suppose we all agree that the contexts of particular classrooms are of great relevance for what happens there, be they social, cultural, economic or other. When we educate teachers according to a given design or approach, we do it in the conviction that we are helping them to develop the abilities we believe they need to work with their students in a given way – be it the ways suggested by, say, NCTM Standards or others.

But there are no ideal students in the classrooms, so, there are no ideal classrooms. Perhaps, being able to switch to traditional approaches is as important as being able to conduct lessons with open ended problems and investigations, and this is the kind of decision making ability that I do not often see being fostered in teacher education programmes.

I want to suggest that we need a carefully designed and conducted research agenda, to investigate how that ‘transposition’ happens, and the actual impact the whole process – teacher education/transposition – has on what happens in the classrooms. With that in hand, we might be able to add, to teacher education programmes, a component in which this process is discussed, including the examination of decision-making processes that involve possible radical changes in the teaching approach adopted in a given circumstance.

Theme 2 papers

Jian-sheng Bao, Yun-quan Lu , and Yan Xia (China): “A hypermedia video-case: A new tool for teachers’ professional development”

R. Elaine Carbone and Patricia T. Eaton (USA): “A Clarion call: Changing CPD for secondary mathematics teachers”

Iben Maj Christiansen (South Africa): “Mathematical competencies and awareness in a teacher education practice”

Mona Fabricant and Sandra Peskin (USA): “Preparing tomorrow’s teachers: The role of the community college (2-year college)”

Juan D. Godino, Pablo Flores and Francisco Ruiz (Spain): “Professional development for mathematics teacher educators through international cooperation the “Edumat-maestros” group”

Theme 3: The relationship between pedagogy and mathematics and the way that relationship may inform teaching practice. Jeppe Skott’s response

I have raised four critical issues related to this theme. The first issue is that teachers need to become flexible and reflective curriculum makers, in the enacted sense of curriculum. I do not think there is much disagreement about this, neither in the papers for this session, nor in mathematics education research in general. However, I think the question of how we may better deal with this situation needs more explicit attention in teacher education.

My other main points may be much more controversial. One is that this new role of the teacher requires us to move beyond modelling good teaching in mathematics teacher education. Another point is that in order for teachers to become autonomous decision makers *also* in relation to their students’ mathematical learning, teacher education needs to adopt a much broader view of pedagogy than one that is linked exclusively to mathematics. And my last critical comment concerns what I perceive as over-individualistic emphases in the larger part of research on teachers and teacher education.



I C M E
1 0
2 0 0 4

TSG

Topic Study
Group 23

There are two aspects to this. One is that teacher education needs to discuss what I call the limitations and opportunities arising from the cracks and openings in the social fabric of specific classrooms. The other is that even if we succeed in educating autonomous professionals who are able to take broader pedagogical concerns and the social structure of the institutional setting into consideration, there are limitations to what should be expected. The notion of implementation, if understood as wholesale incorporation of intentions developed elsewhere into schools and classrooms, does not do justice to the social complexities of school life.

Theme 3 papers

Jeanne Albert (Israel): "What leads to meaningful change in teacher' views of mathematics?"

Milan Hejny and *Darina Jirotková* (The Czech Republic): "The key role of tasks for the development of future primary teachers' teaching style"

Raimo Kaasila, *Erkki Pehkonen*, *Markku S. Hannula*, and *Anu Laine* (Finland): "Pre-service elementary teachers' self-confidence in mathematics at the beginning of their studies"

Margaret L. Kidd (USA): "Factors that enable or impede a transformation of pedagogical style in secondary schools"

Wang Linquan (China): "What are the mathematics teachers' needs in their professional development?"

Theme 4: The impact of theories and beliefs on practice. Tom Cooney's response

The education of mathematics teachers has many facets including consideration of how our theories and beliefs interface with our practice. Were it the case that teachers, teacher educators, students, parents, and society in general agreed about what constitutes "good teaching" the practice of teacher education would be greatly simplified. But this is not the case and consequently there is a certain tension that exists among the various stakeholders in teacher education.

For whatever reason, the practice of mathematics teaching generally does not match the vision of mathematics teaching espoused by various scholars and reform-oriented proclamations. Teacher education is generally designed to promote a reform-oriented teaching style, one which takes advantage of technology and uses instructional strategies that are based on students' understanding of mathematics. Above all, reform teaching emphasizes the processes of doing mathematics, not just the accumulation of mathematical facts and algorithms.

Often we find that descriptions of teachers' practice stop short of linking that particular practice to the practice of many other teachers. In order to make that linkage, we need to have theories that help build bridges among the various cases. This is, perhaps, the most important way that theories shape our work in mathematics teacher education. If our practice of mathematics teacher education is to move beyond the isolation of individual descriptions, we must have some way of talking to one another about good teaching in a language other than the language used to tell our stories about good teaching. One of our tasks is to consider what and how theories can contribute to our thinking across cases and thereby influence both our research and practice in mathematics teacher education.



I C M E
1 0
2 0 0 4

TSG

Topic Study
Group 23

Theme 4 papers

Kim Beswick (Australia): "Factors preventing one mathematics teacher from changing her beliefs and practice"

Olive Chapman (Canada): "Facilitating reflection in pre-service mathematics teachers' education"

Eileen Fernández and *Mika Munakata* (USA): "Developing mathematical resourcefulness in middle school teachers"

Merrilyn Goos (Australia): "Learning to teach with technology: A sociocultural analysis"

Victoria Sánchez and *Mercedes García* (Spain): "Thinking about mathematics education for future teachers"

For full reports from the four respondents please contact b.jaworski@lboro.ac.uk, or contact the respondent directly.

Small group activity

Discussion in small groups, in each of the four sessions, was lively, and there was good feedback from participants that this discussion had proved valuable and enjoyable. Sadly time did not allow collecting of detailed comments from groups, but short feedback from groups was included in each of our sessions. Again, feedback suggested that time had been spent profitably within the group sessions. It was a pity that small group work had to be conducted uncomfortably in a tiered lecture theatre with fixed seats, but people suffered the discomfort cheerfully in order to achieve good communication.

This report has been written by Barbara Jaworski. She will be happy to be contacted at b.jaworski@lboro.ac.uk for further information on the work of this TSG.