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Introduction to the papers of TWG18: Mathematics teacher education and professional development

Stefan Zehetmeier¹, Marc Bosse², Laurinda Brown³, Alena Hošpesová⁴, Nicolina Malara⁵ and Bettina Rösken-Winter⁶

1 University of Klagenfurt, Faculty of Interdisciplinary Studies, Klagenfurt am Wörthersee, Austria, Stefan.Zehetmeier@aau.at

2 University of Duisburg-Essen, Faculty of Mathematics, Essen, Germany

3 University of Bristol, Graduate School of Education, Bristol, UK

4 University of South Bohemia Ceske Budejovice, Faculty of Education, České Budějovice, Czech Republic

5 University of Modena & Reggio E., Faculty Education and Human Sciences, Modena, Italy

6 Humboldt-Universität zu Berlin, Professional School of Education, Berlin, Germany

RATIONALE

The study of mathematics teacher education and professional development has been a central focus of research over recent decades. Research activities have focused on topics such as reflection, collaboration and teachers' professional growth. In particular, models and programmes of professional development, as well as their respective content, methods, and impacts have been described and analysed. Research has increasingly focused not only on the participating teachers, but also on the role of teacher educators and academic researchers. So far, the research community has attempted to develop theoretical and methodological frameworks to both *describe* and *explain* the complex topic of mathematics teacher education and professional development.

The goal of TWG18 was to offer a communicative, collegial and critical forum for the discussion of these and other related issues, which would allow diverse perspectives and theoretical approaches to contribute to the development of our knowledge and understanding as researchers, educators and practitioners.

PARTICIPANTS

39 papers underwent a peer review process in TWG18: during this process, all papers were revised, according to reviewers' remarks, by authors. 34 papers were accepted as contributions and five were re-submitted for poster presentation. Four of the accepted papers

were withdrawn. Finally, 30 papers were presented during the TWG sessions.

19 posters (14 original submissions and 5 former paper submissions, see above) underwent a peer review process in TWG18: all authors revised their posters, according to the reviewers' remarks. All of the posters were accepted. Four of the accepted posters were withdrawn. Finally, 15 posters were presented during the conference poster session.

ORGANISATION

Due to the high number of participants and presentations, the TWG sessions comprised both plenary and sub-group working phases. During the plenary phases, three (or four) papers were presented for a maximum of five minutes each, in which the authors provided their respective paper's central message(s) and challenging questions for discussion. These plenaries were followed by parallel sub-groups, which were each managed by one of the presenting authors. Participants were free to choose and join one sub-group, where they discussed the paper for 20-30 minutes. Afterwards, the TWG's participants met in plenary to hear reports of each sub-groups' central topics and to summarise emerging issues.

TOPICS

The presentations were categorised into seven main topics:

- Models of Teacher Education Programmes
- Pre-Service Teacher Education
- Lesson Study and Videos in Teacher Education
- Tasks, Problems and Assessments
- Mathematics Teacher Educators
- Reflecting Teaching Practices
- Cooperative Communities

Within the topic “Models of Teacher Education Programmes”, the papers dealt with teacher education programmes, teacher educators, teachers’ professional growth, training models, teachers of levels K-8, teacher empowerment, problematisation of knowledge, meta-didactical transpositions and praxeologies.

The topic “Pre-Service Teacher Education” comprised teacher preparation, pre-service primary and secondary mathematics teachers, inquiry based mathematics education, students’ mathematical thinking, scaffolding, one-to-one interactions, deficits pertaining to core mathematics, positive attitudes towards mathematics, analyses in one-on-one interviews, diagnostic strategies, subject matter knowledge and knowledge base for teaching.

The session on “Lesson Study and Videos in Teacher Education” focused on lesson study, video-based professional development, mentor teachers, pre-service and in-service teachers, pedagogical content knowledge, theory-practice problems, initial teacher education, classroom situations, teacher expertise, peer discussions, anthropological theory and mathematical knowledge for teaching.

The papers of “Tasks, Problems and Assessments” dealt with task design, learning scenarios, problem posing, problem solving, teacher professional competencies, a four-step dynamic model, characteristics of a good (mathematics) teacher, and levels of cognitive demand.

The topic “Mathematics Teacher Educators” comprised practices of teacher educators, prospective teachers, mathematical knowledge, awareness, students’ errors, non-standard reasoning, instructional coherence of teacher educators, teaching-learning en-

vironments, impact on teacher and student learning, professional development and social network sites.

The focus of “Reflecting Teaching Practices” was on self-reflection, beginner teachers’ practices, content and methods of professional development courses, mathematical quality, didactical analysis competency, pedagogical content knowledge, didactic transposition, anthropological theory of didactics, content representation, spatial visualisation ability, teaching experiments, common games and childhood education.

Within the topic “Cooperative Communities” the papers dealt with communities of practice, inquiry communities, developmental research on tasks, identity and social perspectives on learning.

EMERGING ISSUES

This section provides several questions and issues which emerged during the sessions of TWG18:

Models of Teacher Education Programmes

- How do we deal with the differences between the role of the mentor and the mathematics educator?
- How can we evaluate teachers’ changes from their classroom actions?
- How can we assess the stability of change induced in the teachers?
- If we analyse ourselves when we work as teacher educators, what are possible problems, or advantages?

Pre-service Teacher Education

- How does our take on the nature of mathematics affect our studies?
- Perspectives are hard to change and student teachers learn to answer what their teacher educators want – do you consider this when designing research?
- How are student teachers able to identify and imagine key aspects of development and the learning trajectories of their students?

- How can we measure the effectiveness in the development of prospective teachers of 1-1 interactions with students? How do we research this?
- How do we measure immediate and long-term effects?

Lesson Study and Videos in Teacher Education

- How does Lesson Study literature fit into wider perspectives such as teacher knowledge?
- Lesson study across countries and across different subjects is different due to cultural background. How can we map the territory?
- How to make change visible?
- How to keep the balance between quantitative and qualitative aspects within conference papers with reduced length?

Tasks, Problems and Assessments

- There is a job to be done in mapping and bringing together, rather than separating mathematics, didactics and pedagogy. After the mapping, what is our vision, what would we propose?
- Theoretical frameworks that are too general are not helpful for teachers. Which tasks could illustrate more specific points of frameworks?
- Notions and definitions: what is problem-posing, problem-solving; is problem-posing a part of problem-solving? How clear are we with notions and definitions?
- It is important to work with teachers in PD programmes. But the question remains: What will the teachers do with the PD in their classrooms?
- Mathematics Teacher Educators
- Thinking through our roles as teacher educators we are also researchers – how can we manage this?

- How to reflect on philosophy of mathematics and the philosophy of mathematics education? How do they meet?
- How can we assess a chain of effects in teachers' professional development?
- How to conduct research on the internet with social communities? There are ethical issues and how do we deal with these? How to intervene in a group as a researcher?

Reflecting Teaching Practices

- How to deal with being (at the same time) a researcher, a teacher, and an educator?
- How to access practice if we want to use that as a research object?
- How to optimise teaching time? How to focus during that time on the deep questions teachers face about mathematics?
- Teacher education is heterogeneous across one country. How can we make comparisons between countries?
- Culture is so important in comparing countries. What are the valid lenses we can use in comparisons?

Cooperative Communities

- Difference between 'community of practice' and 'community of inquiry' – what makes an inquiry community? How will we recognise it in the data?
- What is relevant to the teachers within the community?
- The roles of researchers and teachers when we do research on practice – symmetry, asymmetry?
- How can we actually observe identity development in terms of practice?