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# Thematic working group 11: Comparative studies in mathematics education

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## Introduction

As with earlier CERMEs, TWG 11 adopted an eclectic perspective in its interpretation of comparison as referring to any study that documents, analyses, contrasts or juxtaposes cross-cultural or cross-contextual similarities and differences across all aspects and levels of mathematics education. In this way the TWG aimed to encourage critical but supportive discussions around a number of themes, some of which were predetermined by the papers received by the group, while others emerged from them.

A recurrent but very productive aspect of this working group has been the relatively small number of paper presentations, although this has also led to the group being constantly on the verge of extinction. This year, thirteen papers and one poster were received. Unfortunately, for various reasons, two papers were withdrawn, leaving eleven papers and a single poster. This created space not only for colleagues to share their research in detail but for everyone to engage in lengthy and inclusive discussions on the nature of comparative mathematics education research and the means by which it can be meaningfully and rigorously undertaken. In particular, as is discussed in more detail below, the group came to realise that concepts like ‘unit of analysis’ meant different things to different people according to the research traditions from which they derive. The various contributions fell naturally into five themes that framed the different working group sessions.

### Theme 1: Assessment in mathematics education

The first theme drew on two papers with very different foci and methodological conceptualisations focused on assessment in comparative mathematics education research. On the one hand, Cascella and Giberti’s paper, drawing on Italian national test data, highlighted significant gender differences in the ways in which students respond to different presentations of the same arithmetical task. Such findings remind us that the debate concerning gender differences in mathematical understanding are by no means resolved. On the other hand, Simsek, Jones, Xenidou-Dervou and Dowens’ study, framed by the important assertion that if “the same instrument is used in different cultures, no bias should arise from the particular characteristics of an instrument or its administration, focused on children’s understanding of mathematical equivalence. Their use of an extant American scale with English and Turkish students yielded a different factor structure from the original, highlighting the difficulties of assuming the validity of a test developed in one cultural context for use in another.

## **Theme 2: Mathematics teacher education**

The second theme, drawing on three papers, dealt with issues concerning mathematics teacher education. The first of these papers, presented by Clivaz and Miyakawa, reported on how two groups of students, one Swiss and one Japanese, collaborated, both at a distance and face-to-face, on the planning of the same problem-solving lesson. After planning, each group of students taught the lesson repeatedly in their own cultural contexts. Analyses of the two sets of plans and their respective lessons highlighted well the cultural norms that underpin beginning teachers' practices. The second paper, presented by Gorgorió, Albarracín and Laine and written with the aim of evaluating admissions policies, examined the impact of recent changes to the admission requirements for primary teacher education programmes in Barcelona and Helsinki. The study found that such tools are too contextually situated to facilitate genuine comparison and argue for a better theorisation of the expected knowledge of such students and a measure appropriate for cross-cultural application. Finally, in this session, the paper by Zhang and Wray examined similarities and differences in the sequences and patterns of teachers' questioning practices in secondary mathematics classrooms in the UK and China. Drawing on observations of a dozen teachers in each country, the authors' discourse analyses identified clear distinctions between the collectively-focused questioning of the Chinese teachers and the individually-focused questioning of the English.

## **Theme 3: The analysis of mathematics textbooks**

The third theme, based on two papers and a poster, focused on the analysis of mathematics textbooks. The first paper, presented by Hemmi, Lepik, Madej, Bråting and Smedlund, examined the presentation of material focused on expressions, equations, inequalities, and the meaning of the equal sign in textbooks in grades 1-3 in Estonia, Finland and Sweden. They found considerable variation in the presentation of such material, with concomitant opportunities for the later learning of algebra, both between countries and between different language groups within countries. The second paper, presented by Xenofontos, examined the use of the word 'problem' in the state mandated upper primary and lower secondary textbooks of the Republic of Cyprus. He found, with inevitable consequences for the coherence of children's learning of mathematics, that while the word was used frequently and consistently in the primary books, it was used rarely and less consistently in the secondary. Finally, Palm Kaplan presented her poster comparison of the algebra tasks found in year 8 Swedish textbooks and the TIMSS 2003 assessments. Her discourse analytic approach showed considerable differences in the privileged content of the two sets of data.

## **Theme 4: Curriculum**

The fourth theme, comprising two papers, focused on curriculum. The first paper from a multinational group of scholars, Van Steenbrugge, Krzywacki, Remillard, Koljonen, Machalow and Hemmi, examined recent mathematics curriculum reform efforts in the US, Finland, Sweden, and Flanders. Drawing on a range of data sources they showed that curriculum reform that is both region-wide and supported by teachers is a major challenge, not least in systems where teachers enjoy autonomy and textbooks are largely unregulated. Jablonka's study, the second in this theme and initiated by international tests of achievement, found that the mathematics taught in Germany

was intellectually more challenging than that taught in China. However, bringing to the group a concept that provoked much discussion, Chinese teachers experienced greater discretionary space than their German colleagues. That is, they had more adaptive freedom in the planning of their teaching.

### **Theme 5: Methodology**

The final theme, drawing on two papers, differed from the others in its explicit focus on methodology. The first of these, Petersson, Sayers and Andrews, presented an analysis of textbooks based on the use of moving averages to highlight the location and extent of different content emphases. Such an approach, which facilitates comparison between textbooks, offers an important visual support to conventional frequency analyses. The second, Chan and Clarke, alerted group members to the importance, particularly for comparative research, of identifying an appropriate unit of analysis. This particular presentation, despite the issue having been discussed in previous CERMEs, provoked a long discussion, which is revisited below, on how the expression ‘unit of analysis’ is construed differently by different cultural groups.

### **Discussion**

As with previous CERMEs, the variety of topics and methodologies brought to the group highlighted well the diversity of work undertaken within the broader field. All papers offered insights to remind us that comparative research, which includes much mainstream work undertaken in single cultural contexts, is a messy and complex undertaking reliant on strong theoretical foundations and clearly-defined constructs. In this latter respect, the group’s discussion on unit of analysis was particularly interesting as it became increasingly clear that colleagues were not talking about the same thing. On the one hand, colleagues working in a theory-driven tradition tended to construe the unit of analysis as the theoretical framework within which they worked. On the other hand, colleagues working in a problem-driven tradition, typically Anglophone, saw the unit of analysis as the individual piece of data to be analysed. These very different conceptions of the phrase highlighted well the difficulties faced by all researchers and the dangers of assuming a common understanding of what one might typically expect to be unproblematic. Of equal interest, as indicated, was the notion of discretionary space. Here, colleagues were able to see the methodological advantage such a simple yet powerfully evocative concept brings to analyses of curricula and teachers’ engagement with them.

As always, the various contributions brought to the group reflected not only cultural diversity but also methodological pluralism. For example, studies included those that were informed by a priori theoretical assertions and those that were not. There were equal numbers of qualitative and quantitative studies focused on a range of aspects of children’s and teacher education students’ learning of mathematics. All studies confirmed the extent to which mathematics and its teaching and learning are culturally normative.