

TSG 1: New developments and trends in mathematics education at preschool level

Team Chairs: Terezinha Nunes, Oxford University, terezinha.nunes@education.ox.ac.uk
Douglas Clements, Buffalo State University, clements@buffalo.edu
Team Members: Sue Gifford, xxxxxx
Clotilde Juárez, xxxxxx
Catherine Taveau, xxxxxx

In TSG 1 we focused on contemporary developments in mathematics education at the preschool and initial years of primary level (approximately ages 0-7 years). Our aim was to promote cross-fertilisation between theory and practice, research and developmental activities.

We invited presentations on a range of topics listed on the website. Papers were submitted to and reviewed by the Team Chairs. A total of 20 papers on research or classroom experience were accepted. Three speakers were not able to attend so the programme included 17 presentations. The team decided to use the time freed by these speakers to offer participants the opportunity for a very brief presentation; two participants took up this opportunity. The presenters came from 12 different countries and no country was represented more than three times in the programme. Speakers' backgrounds varied and included teacher educators, researchers, university staff teaching at different levels, and school teachers, resulting in a balance between description of experiences and research.

The papers presented focused on three main themes.

1. Children's informal knowledge and their development in pre-school or early primary school.
2. Pedagogy for teaching mathematics to young children.
3. Teacher education for pre-school and primary school.

The number of papers in each theme varied, and some papers could be classified in more than one theme. The final programme organisation considered the theme as well the domain of mathematics addressed in order to create opportunities for exchange within a domain.

The first day focused on children's informal knowledge and their use in the classroom in solving problems. All three speakers discussed the importance of using children's informal knowledge and of developing it through carefully designed instruction. Terezinha Nunes focused on children's knowledge of the inverse relation between addition and subtraction for children's learning of number concepts and operations. Luz Stella López discussed the importance of this concept for young children's problem solving. Miriam Amit presented an analysis of how children's spatial concepts can be developed in the classroom and connected to two-dimensional representations in maps of the classroom, thereby preparing them for geometry learning.

The second session of TSG 1 focused on pedagogy and teacher knowledge in the domains of number and space. Sue Gifford discussed the importance of planning cumulative experience, building on children's spatial memory, combining kinaesthetic, visual, and verbal learning, and providing opportunities for problem solving and discussion. Rose Griffiths described children's experiences with counting at home: parents practise counting forward, with or without objects, but they do not use situations that would result in counting backwards or counting on. Teachers can make use of this information to design instruction. Allan Tarp discussed the difficulties of the base-ten system, where the marker for achieving one group can be seen as a zero (ten is written as 1-0). He suggested that working with other kinds of groups, where the group will be explicitly written (1-5 would represent one group of five) can help children understand the concept of base and presented different activities where this idea could be used. Pamela Perger explored the diagnostic interview used in the New Zealand Numeracy Framework and activities designed in their Strategy Teaching Model for pre-school. Marjorie Samuel Sánchez described

Chilean pre-school teachers' informal knowledge of significant notions such as number, space and time. She found that their knowledge of number and space concepts would benefit from further development, particularly in terms of formalisation of their informal understanding.

The third session of TSG 1 focused on pedagogy. It involved a discussion of how specific approaches can be used to further young children's mathematics knowledge. Catherine Taveau analysed how construction, spatial reasoning, and visualisation are important activities that lead to the construction of geometrical objects, and described different activities that can be implemented in pre-school to further children's knowledge. Sylvia van den Boogaard described the use of picture books to promote children's discussion of numerical and spatial concepts in pre-school. Specific forms of teacher interaction, such as asking oneself a question, playing ignorant, and showing an inquiring expression were highlighted as key to promote children's explication of their number concepts and strategies. Shiree Lee argued for the importance of children's play and of an environment that has potential for hands-on discovery in providing opportunities for children to lay the foundations of their mathematical understanding.

The fourth and final session of TSG 1 focused on children's informal knowledge and its use in a pedagogy appropriate for working with young children. Douglas Clements described TRIAD, a Technology-enhanced, Research-based, Instruction, Assessment, and professional Development programme designed to promote pre-school children's learning trajectories in mathematics. His presentation included assessments of its effectiveness and examples of how the programme works. Fenna van Nes described a programme for promoting pre-schoolers' number skills based on perceptual patterns and finger representation. Her talk focused on observations of children's use of these patterns and the design of activities that incorporate these into problem solving. Ema Mamede described young children's understanding of equivalence and order of quantities that are normally represented by fractions, resulting from divisions where the dividend is smaller than the divisor. She argued that children show some understanding of the logical relations between these quantities even before they learn fraction labels to describe the quantities. Hugo Rodriguez Carmona presented manipulatives that can be used to help young children understand the meaning of fractions and operations with fractions. He described different ways in which these can be used both in the context of quotative and partitive division problems. Shiree Lee presented the results of a baseline assessment of young children's mathematics knowledge carried out in New Zealand, which revealed that many children have a much higher level of mathematics knowledge than their teachers anticipate. The implications of this finding for young children's mathematics education and curriculum design were discussed.

At the final session, the group was also given the opportunity to assess how well it had functioned and possible suggestions for the future. The participants were overwhelmingly positive about the group's organisation and expressed a preference for maintaining short presentations (15 minutes, as in this programme) that allow for exploring a variety of ideas, rather than longer presentations that would restrict this variation. One suggestion for the future was that full papers (with a word limit) could be placed on the ICME site by presenters for later consultation by ICME participants. The organisers of this group are favourable to this suggestion but would like to indicate that it would be very difficult to review the full papers. It is suggested that, if full papers are included, there should be an indication that they were not refereed for publication on the site.

Some participants were not aware that a call for proposals is issued about one year before the event and wished that they had know about it. It is difficult for the organisers of a TSG to address this issue in the future. If the organisers of ICME-11 compiled a list of email addresses, this list could be used by the organisers of ICME-12 to send a brief message to call the attention of previous participants to the new website when it goes live and to alert them to the calls for proposals.