Topic Study Group 3.1: Mathematics education at early childhood and primary level

Strand B

Team details*

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Overview

TSG 3.1 focuses on the foundations of learning mathematics. The aim is to share and discuss contemporary research on early childhood mathematics development and teaching and their theoretical and methodological frameworks. TSG 3.1 involves research on children's mathematical development from birth through the primary grades. Such research is critical for at least four reasons.

1. Mathematics is increasingly vital in a modern global economy, but in terms of mathematics achievement there are wide and sometimes increasing disparities between countries and socioeconomic groups (Bachman et al., 2015; Gerofsky, 2015; Mullis et al., 2019). Therefore, interest in improving early childhood mathematics education has emerged around the globe,

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with a particular focus on children who have not been provided equal access to learning opportunities (Burchinal et al., 2016; Fritz et al., 2019; McCoy et al., 2018).
2. Early years learning experiences have been found to impact development through school and throughout life in substantial ways.
3. On the positive side, in supportive environments, research over past decades shows young children are more capable of developing mathematical concepts and reasoning across a range of concepts beyond number and arithmetic much earlier and in more diverse ways than previously thought.
4. Likewise, teachers supported by research-validated professional development and curricula are more effective and enjoy the reasoning and learning that high-quality education brings forth from their children.

Areas of interest

To gain insight into these issues, TSG 3.1 invites empirical and theoretical contributions to the didactics of mathematics, (neuro-) cognitive, developmental, sociocultural, and other approaches within the following sub-themes.

1. Innovative approaches that consider equity issues from the start (not an "add-on"). Research and development that goes beyond documenting diversity and inclusion problems to create and evaluate solutions is urgently needed.
2. Much attention has been given to learning trajectories (LTs), opening new questions. Can they be extended and validated through the primary grades? Do different cultures and different individuals follow different LTs? If so, what components of an LT must be changed: goals, developmental progressions, or instruction? What is the effect of political influences on enacted LTs, such as curricula frameworks directing the course of instruction instead of LTs?
3. Simplistic dichotomies often plague early education, and Early Childhood Education (EC) mathematics is no exception. Examples include play vs. academic approaches and cognition vs. affect. Investigation is needed to address such dichotomies, such as resolving or merging them. In a related vein, we need investigations of ways that false storylines (Herbel-Eisenmann et al., 2016) remain fossilized and what experiences/interventions might lead to a dialectical synthesis.
4. One critical area lies in designing, evaluating, and implementing high-quality ECE mathematics curricula, including assessments that serve teaching and learning (e.g., formative assessment using interviews or curriculum-embedded assessments). Frameworks for the integration of research and curriculum development are emerging (e.g., Bannan-Ritland, 2003; Boerst et al.,

2010; Burkhardt, 2006; Clements, 2007; Kimpston & Rogers, 1986; Lewis et al., 2006; The Design-Based Research Collective, 2003) but critical research reviews and evaluation in the area of early mathematics education are needed.

5. Geometry, spatial thinking, structure and pattern, and statistical reasoning are essential topics in mathematics and help build a foundation for learning other mathematical topics, advanced mathematics study, and other subject matter areas, such as STEM. However, in many countries these do not play a significant role in educational policy, praxis, and even research, although studies are increasing in some countries. Integration of these and other areas, such as literature, is another burgeoning area of research.
6. Teachers' knowledge is critical. What professional development interventions and other factors, such as support from administrators and school systems and educative curricula (materials designed to support teacher and child learning) increase teachers' pedagogical knowledge and enjoyment of children's developing mathematical reasoning and learning?
7. Learning in preschool is often disconnected from learning in the primary grades, posing critical challenges for policymakers and educators. Despite efforts towards more significant alignment and continuity, there is little research on the impact of various policy alignment and continuity strategies on students' experiences and learning outcomes as they move from preschool through the early elementary grades.
8. Finally, other general issues might be addressed. For example, how has the field advanced since ICME-14 and even ICME-5, which was the first to address ECE? What movements and types of studies and methodologies have gained momentum or favour globally (e.g., embodiment theory)? Are there significant shifts in researchers' attention and thinking about early mathematics? Are research domains showing increasing collaboration, or do disciplines remain isolated?

How to make a submission to this Topic Study Group

Submissions for Topic Study Group Papers and proposals for Posters open 28 April 2023 via the official ICME-15 website, icme15.org. The website also contains a timeline of dates for the activity of the Topic Study Groups in the lead up to the Congress.

For questions about this TSG, please contact the Co-Chairs using the email addresses provided.