TSG 19 Problem solving in mathematics education

Co-chairs:
Peter Liljedahl (Canada) liljedahl@sfu.ca
Manuel Santos Trigo (Mexico) msantos@cinvestav.mx

Team members:
Uldarico Malaspina (Peru)
Guido Pinkernell (Germany)
Laurent Vivier (France)

IPC Liaison person: Elaine Simmt (Canada)

Introduction

Mathematical problem solving has been an important research and practice domain in mathematics education worldwide. Its agenda focuses not only on analysing the extent to which cognitive, social, and affective factors influence and shape learners' development of problem solving proficiency, but also on the role played as a medium for teaching and learning mathematics and the development of both teachers' and learners' problem solving proficiencies. TSG 19 on **Problem Solving in Mathematics Education** is dedicated to the furthering and sharing of knowledge on this important topic.

To this end, we invite the mathematics education community to submit contributions that address themes relevant to **Problem Solving in Mathematics Education** to ICME 13. All submission should follow directions provided in the 2nd Announcement, pp. 30-31 (http://icme13.org/files/2nd_announcement.pdf). To help orient the focus of possible contributions, we identify some areas or themes that your submission might include:

1. **Problem Solving Foundation**: What is required to support a research program in mathematical problem solving? What principles are important to relate problem solving activities and learners' construction or development of mathematical knowledge?

2. **Problem Solving and Student Learning**: How are mathematical practices, as developed within the mathematics community, related to students learning of the discipline? What does it mean to focus on problem solving activities to frame and foster students' learning? How do students solve problems? How do students learn and develop an expertise to solve problems?

3. **Problem Solving Frameworks**: What do problem-solving frameworks involve? And why are they important? How have those framework evolved? How has language (routine, non-routine tasks, heuristics, metacognition, etc.) to explain problem-solving approaches been adjusted to analyse emerging approaches based on the use of digital technologies? How do problem-solving frameworks from mathematics relate to problem solving frameworks in mathematics education?

4. **Curriculum**: What does a curriculum that is structured around problem solving activities involve? What problem solving principles are explicitly addressed in content organization of K-12 education? To what extent do proposals based on problem solving approaches make explicit interrelations between content and mathematical processes?

5. **Problem Solving Assessment**: How are, or should, learners' problem solving competencies be assessed? What is the role of international assessments in fostering learners' problem solving experiences?

6. **Digital Technologies and Problems Solving**: What ways of reasoning about concepts and problems do learners construct when they rely on the systematics use of technologies? How do learners appropriate technologies' affordances in problem solving environments?

7. **Problem Solving and Creativity:** How is creativity a part of problem solving? How is creativity fostered within problem solving environments, curriculum, and assessment? How is creativity accounted for in problem solving heuristics?

8. **Problem Posing:** What types of tasks are important to foster learners' formulation of problems and solutions? How is problem posing related to problem solving? How should curriculum and learning environments include and assess learners' problem posing activities?

9. **Problem Solving Beyond School or Formal Settings:** How are problems or tasks that appear in non-school environments related to those that are discussed in school? What type of mathematical discussions can be fostered

among learners after regular classes? What is the source of problem solving practices in out-of-school settings?

10. **Problem Solving and Teachers Education:** Are there problem-solving programs to prepare teachers across all educational levels? What should they include? How can a problem-solving program for teachers' practice be designed and implemented? How do we prepare in-service and pre-service teachers to teach in a problem solving rich curriculum?

11. **Problem Solving and the Design of Interactive Materials and Textbooks:** What types of mathematical tasks are important to orient guide learners to the development of mathematical thinking? How should those tasks be presented? To what extent should learners be asked to look for different ways to represent, explore and solve mathematical tasks? How should students deal with tasks that can be modelled dynamically?

12. **Problem Solving Task Design:** What are the characteristics of a good problem? What methods can be used in designing problem solving tasks? What is the relationship between problem solving task design and problem posing? Should students design their own problem solving tasks?

13. **Problem Solving and Modelling Approaches:** How are problem-solving frameworks related to modelling approaches? What is the relationship between modelling heuristics and problem solving heuristics? How do students draw a distinction between problem solving and modelling?

14. **Problem Solving and Affect:** How do students experience problem solving? What are the affective effects of problem solving? How do students' emotion, motivation and beliefs shape their development of problem solving competencies?