

**The 12th International Congress on Mathematics Education (ICME12),  
Seoul, Korea: July 8-15, 2012**

**Topic Study Group 15: Mathematical Problem Solving  
Call for Contributions**

**Introduction**

Mathematical problem solving (MPS) is a field of study with a long history and has supported numerous research programs in mathematics education at all levels. Given the importance of MPS, the orientations and structure of many curriculum proposals and teaching models throughout the world have been either directly or indirectly influenced by it. However, the variety of problem solving programs with different agendas and practical implications makes it necessary to revise and reflect on their common foundations, nature, and historical development, and to build up and implement problem solving approaches to support and foster students' learning, and the development of mathematical knowledge and competencies.

In addition, the availability and use of digital tools in both real world and school environments require that researchers and practitioners review, analyze, and discuss the ways in which the tools could help students enhance and build up their mathematical knowledge. Thus, all the participants in the academic activities of the Topic Study Group will have an opportunity to reflect on and discuss issues and themes that address the relevance, research programs and results, current trends and agendas, and developments in MPS. The initial list of themes to frame and structure the sessions is presented here:

1. **Origin, a historical overview, and characterization of mathematical Problem Solving.** The aim of this section is to document and reflect on the roots and evolution processes of the MPS from philosophical, psychological, social, and cultural perspectives. The systematic discussion of these aspects will help us characterize and distinguish the rationale to think of and to relate problem solving approaches to the processes of comprehending and constructing the mathematics knowledge of students. As well, the discussion provides us with an opportunity to talk about the nature and characteristics of conflicting and controversial terms such as problem, assessment, and routine and nonroutine tasks.
2. **Foundations and nature of mathematical problem solving.** The purpose is to identify and discuss principles or tenets that explain problem solvers' cognitive behaviours to justify the development and construction of mathematics knowledge in terms of problem solving activities.
3. **Problem solving frameworks.** The aim is to carefully review the extant frameworks that are currently used to structure and support research and curriculum reforms in MPS. In particular, the focus will be on discussing the extent to which these frameworks either explain students' mathematical problem solving behaviours, or serve as tools to explain why and how students construct new mathematical knowledge. In addition, it will be fruitful for furthering the field by making clearer distinctions among the existing frameworks in terms of their particular characteristics.
4. **Research programs in mathematical problem solving.** The aim is to identify and revise ways in which research programs have contributed to the development of the field within many different contexts and research traditions. In particular, a discussion on how research findings in MPS are disseminated and used in different education systems.
5. **Curriculum proposals.** The purpose is to discuss the distinguishing features of a mathematics curriculum that is structured around various problem-solving approaches. In particular, to identify and examine feasible ways to clearly relate problem-solving principles to the organization and structure of mathematical contents, processes and

habits of mathematics practices. In addition, to address ways in which MPS could be integrated across curricula.

6. **The influence of social and cultural perspectives on problem solving approaches.** The purpose is to discuss and document the extent to which social and cultural perspectives shape the ways of conceiving and implementing various problem-solving approaches.

7. **Problem solving assessment.** The purpose is to identify and discuss different ways of assessing students' problem solving performances. In particular, to discuss the extent to which international studies such as TIMSS and PISA assess students' problem-solving processes and competencies. Furthermore, it will be important to discuss the effect of promoting mathematical competitions and in specific, mathematics Olympiads to enhance students' problem solving approaches.

8. **Problem solving and the use of digital tools** (internet, computer software, hand-held calculators, Ipads, etc.). The purpose of this section is to analyse the different ways of reasoning that students might construct as a result of using systematically such tools. For example, to analyze the extent to which the use of the tools enhances heuristics and representations used in paper and pencil environments.

9. **Problem solving outside schools.** It is recognized that a variety of activities with which students are engaged outside the school environment could play an important role in their mathematics learning. Thus, it is important to identify and discuss different ways in which students can participate in out-of school problem-solving activities that involve realistic and complex tasks.

10. **The role of problem solving in teacher education (both pre-service and in-service).** The aim is to discuss the ways in which, pre-service and in-service teachers could develop their mathematical and didactic knowledge for teaching via problem solving approaches.

11. **Problem solving and university / tertiary education.** In this section, we will address themes related to the use of problem-solving approaches to study the content of university mathematics. In particular, the role of problem solving in grasping big ideas such as infinity and proofs.

12. **Future directions and advances.** The purpose is to identify future trends and directions in research, curriculum developments, and teaching of mathematical problem solving as a field of study.

## Submissions

We invite the mathematics education community to submit proposals addressing the themes listed above and others related issues. The proposal should be around 8 pages and should be sent to the group co-chairs by **October 31st, 2011** via email. The members of the organizing group will review each proposal. The results and comments will be sent by **January 15, 2012**. And, the final version of the contribution should be sent by **April 10, 2012**. Any question that you might have, please send an email to any member of the group.

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