Topic Study Group 1.9: Teaching and learning of computational thinking

Strand A

Team details

Co-Chairs

Chantal Buteau (Brock University, Canada; cbuteau@brocku.ca)

Tay Eng Guan (National Institute of Education, Singapore; engguan.tay@nie.edu.sg)

Members

Djordje Kadijevich (Institute for Educational Research, Serbia)

Simon Modeste (Université de Montpellier, France)

Max Stephens (University of Melbourne, Australia)

IPC Liaison

Inge Schwank (Universität zu Köln, Germany)

Overview

In order to successfully engage in problem solving and product creation in today's technology-based world, students now need to develop computational thinking (CT). This necessity has raised an interest among policy makers around the world resulting in significant school and program reforms. Indeed, over the last 15 years, various countries have seen a rapid integration of CT in education. This integration has taken different forms, for example by introducing coding, programming or algorithmics, often in standalone computer science curricula, within the context of mathematics education, or through a transdisciplinary approach (i.e., across multiple disciplines). The growing demand to cultivate CT in contemporary mathematics education is further evidenced by the Program

for International Student Assessment (PISA), which is assessing students' CT starting with its 2021 study cycle (OECD 2018).

Such rapid and widespread interest raises many questions for the mathematics education community. What are the current realities of teaching and learning of CT in relation to school and university mathematics classrooms? To what extent and how is research informing mathematics teacher education and practices to support the development of CT? What theoretical perspectives and methodologies are relevant for studying the teaching and learning of CT in relation specifically to learning mathematics and what theoretical or practical results have emerged? For example, what is the relation between mathematical thinking and computational thinking? How should content, practices and computing tools influence each other to support the development of mathematical thinking through applying CT? What obstacles to integration have occurred and how have they been overcome? What affordances have been observed and how have they been exploited? Which mathematical practices and contents may be particularly suitable to connect certain aspects of CT with mathematical thinking?

The aim of this TSG will be to explore questions like these, and to:

1. Exchange information about evolving trends and perspectives regarding the inclusion of CT (in mathematics learning) within various educational contexts from around the world;
2. Exemplify teaching activities that would support the learning and teaching of mathematics through applying CT; and
3. Present resources to support teachers in incorporating CT in their mathematics teaching.

Areas of interest

We invite research-based or practice-based contributions concerning any level of education (from pre-kindergarten to university) and any topic related to the teaching and learning of CT in the context of mathematics. These include (but are not limited to):

- Epistemological, historical, or cultural discussions of the links between mathematical and computational thinking;
- Task design and resources (for teachers, students, parents, policy makers);
- Curriculum development issues, involving decisions about for whom, when, and within what context CT should be taught;
- Classroom realities of teacher and student practices;
- Initial and professional teacher education;

- Student learning of CT in the context of/for mathematics learning and student learning of mathematics needed to support their development of CT; and
- Theoretical and methodological frameworks from cognitive psychology, sociology, anthropology, epistemology, history of science, etc.;

Any of these topics may be addressed generally by participants, or with specific reference to different educational levels: e.g., primary (Years K-6), junior secondary (Years 7-9) or senior secondary (Years 10-12), or post-secondary (Years 12+). Furthermore, we encourage authors to explicitly highlight in their contributions, if relevant, the co-development and/or interactions of CT and mathematical thinking, as manifested in different mathematical practices, such as algorithmization, experimentation, approximation, conjecture testing, visualization, and modelling, many of which are today increasingly influenced by computation. Contributions from researchers in other areas, especially computer science education, are welcome.

Even though TSG 3.7 and TSG 3.8 are closely related to this theme as they concern digital technology, TSG 1.9 welcomes contributions that specifically involve technology supporting CT development, such as programming technology.

Depending on the quality of contributions received and discussion realized, a post conference publication may be prepared and published, such as an edited book or a journal special issue.

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.