TSG 14
TEACHING AND LEARNING OF PROGRAMMING AND ALGORITHMS

The Organizing Team

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The two disciplines, mathematics and computer science, have historically been and still are closely interrelated (for example, with their use of variables and abstraction processes). The enthusiasm of educators for exploiting programming for learning particularly but not exclusively mathematics has a long legacy dating back to the 1970s (cf. Noss & Hoyles, 1996). But it is only recently that programming and algorithmics has achieved more widespread adoption with the consequence that the development of students' computational thinking has raised an interest among policy makers yielding significant school and program reforms. Over the last decade, various countries throughout the world have seen a rapid integration of programming and computational thinking in education, either in standalone computer science curricula, within the context of mathematics education, or through a transdisciplinary approach (i.e., across multiple disciplines).

Such rapid and widespread interest raises many questions for the mathematics education community. What are the current realities of teaching and learning of algorithmics and programming in relation to school and university mathematics classrooms? To what extent and how is research informing teacher education and practices to support the development of computational thinking? What theoretical perspectives and methodologies are relevant for studying the teaching and learning of programming and algorithms in relation specifically to learning mathematics and what theoretical or practical results have emerged? For example, what is the relation between mathematics (teaching and learning) and programming and algorithmics (teaching and learning)? What obstacles to integration have occurred and how have they been overcome? What affordances have been observed and how were they exploited?

The aim of this new ICME Topic Study Group will be to explore questions like these and exchange information about evolving trends and perspectives within various educational contexts from around the world.

To this end, we invite research- or practice-based contributions concerning any level of education (from pre-kindergarten to university) and any topic related to the teaching and learning of programming and algorithmics, either in support of or as supported by the teaching and learning of mathematics. These include (but are not limited to):

- **Epistemological, historical, or cultural discussions** of the links between mathematical and algorithmic/computational thinking;
- **Task design and resources** (for teachers, students, parents, policy makers), including (online) competitions and other extracurricular activities;
- **Curriculum development issues**, involving decisions about for whom, when, and within what context algorithms and programming should be taught;
- **Classroom realities** of teacher and student practices ;
- **Initial and professional teacher education**;
- **Student learning** of algorithms and programming in the context of/for mathematics learning and student learning of mathematics in the contexts of/for algorithms and programming learning; and
- **Theoretical and methodological frameworks** from cognitive psychology, sociology, anthropology, epistemology, history of science, etc.;

Even though TSG 24, TSG 25, and TSG 26 are closely related to this theme as they concern digital technology, TSG 14 focuses specifically on programming technology.

When relevant, please include links to materials available online (such as textbooks, course notes, task lists, supporting software and sites, teachers' manuals, classroom videos, etc.).

References

Noss, R. & Hoyles, C. (1996). *Windows on mathematical meanings*: *learning cultures and computers*. Kluwer Academic Publishers: London.

Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. New York: Basic Books.

Knuth, D. E. (1985). Algorithmic thinking and mathematical thinking. *The American Mathematical Monthly,* 92(1), 170-181.