



TSG 25

THE ROLE AND THE USE OF TECHNOLOGY IN THE TEACHING AND LEARNING OF MATHEMATICS AT LOWER SECONDARY LEVEL

The Organizing Team

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The ICME 14 Topic Study Group 25 *The role and the use of technology in the teaching and learning of mathematics at lower secondary level* will focus on three interrelated themes, build on the current state of the art in the field and adopt an inclusive as well as an international perspective. The three core themes are:

1. Technology in lower secondary education as a *scientific endeavor*. What kind of theories, methods and approaches are we considering and how is this accumulating knowledge and creating stable results?
2. The *role of technologies* in the teaching and learning of mathematics. How do we approach the potentials and challenges of existing and emerging technologies?
3. Teacher in- and pre-service *training* with technologies or as a reply to new demands of technologies. How do teachers learn to use technology in their teaching and how do we enhance teaching training with technology?

The group is an opportunity to establish an international discussion about the interrelations between taught mathematics and technology. As three TSGs are devoted to technology, the group will focus on mathematical topics that are specific for lower secondary school with respect to the integration of technology for mathematics learning and teaching but acknowledging the long-term development of knowledge across the grades.

Mathematics and technology have a long and interrelated history of mutual fertilization, but nowadays the use of technology as well as the use of mathematics is not always transparent. Nevertheless, technology and mathematics has a huge and increasing influence on many aspects of society. Hence the educational attendance to the combination of mathematics and technology that frames TSG 25 is of paramount importance and we should collectively strive for understanding concerns, conditions, theories, methods and approaches that support good teaching and learning practices, accumulate knowledge and create stable results. The three themes serve the purpose of organizing the pursue of that ambition.

We focus on technology in lower secondary teaching as a *scientific endeavor* in order to frame a theoretical and methodological discussion of the use of technology in lower secondary mathematics. A number of theoretical constructs and methodological approaches have been applied and developed in order to investigate the role of technology in mathematics learning, as much as in teachers' difficulty to integrate them. Results and problems remain yet compartmentalised in local theoretical traditions. Recently the mathematics education research community has started to focus on how to gather and integrate such different constructs and results. Initiatives emerged in order to allow circulation and translation between work in different local traditions, for instance through literature reviews and meta-constructs as the networking of theories and methodologies. This question is at the core of this first theme of the TSG 25: we aim at supporting both a paradigmatic organization and room for discussing how the community has taken the problem inherent to multiple perspectives.

Understanding the *role of technologies* in mathematical teaching situations is a complex and diverse task. The range of technologies that are suggesting themselves to the mathematical classroom is wide and expanding. Some technologies come in relative stable form (such as calculators and physical manipulatives), while others are in rapid flux (intelligent CAS tools as Wolfram Alpha, Applications within Virtual Reality and programming languages are examples of this). Some are specifically designed for school mathematics teaching (such as Geogebra), some have been imported from business area (such as spreadsheets). These technologies influence teaching and learning process in mathematics, in ways that have been studied by research for the last three decades, and continue to generate results. We aim at having a panorama of these works, or still discuss about the studies focused on the most recent technologies, in order to see if new questions raise.

Considering the *role of technologies* in mathematics education a clarification of types of mathematical knowledge, skills and competence that the technological development requires or favors is needed. This discussion reaches decades back to the introduction of handheld calculators making some calculation skills obsolete, but more recently the rapid digitalization of the social and economic spheres is increasing the demand for students to develop algorithmic and computational competences.

Technologies and digital tools are of growing importance to all educational systems, and call for *teacher training*. For this reason, there is an ongoing research interest in the field of professional development of teachers using technology. Even if evidence-based methodologies can tell us, whether these tools are succeeding and should be introduced in pre-service teacher education, it remains still the question of the transferability of successful experiments and, more generally, that of how to train teachers to integrate these technologies in their practices.

By having an international audience and perspective on this important issue the role of technologies as well in pre- as in in-service teacher training should be discussed under both theoretical perspectives, as well as empirical evidence. The focus of the discussion in TSG 25 contains both the question of learning how to teach with technology and that of using technology for teacher training (e.g. in a blended learning setting or an online class).