

CERME 14: Thematic Working Group 25

Teaching and learning of Calculus

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Scope and focus of the Working Group

Calculus is a central topic of secondary mathematics in most European countries; the learning and teaching of topics related to calculus often starts in the early high school grades (variables, covariation, graphs, functional thinking, rates of change) and continues to the first year of university mathematics, including service courses for STEM majors and others (e.g., economics majors) and beyond to multi-variable calculus.

Research on the learning and teaching of calculus has been an active area since at least the 1980s and has become a central concern of many researchers recently. The concerns of recent research on calculus include students' preparation for calculus including: aspects of functional thinking, rate of change, and accumulation; students' conceptions for the fundamental notions of calculus and curricular issues; calculus as a link between mathematics and everyday situations, STEM disciplines or professional practices; and calculus as preparation for analysis; pre-service and in-service teachers' professional development related to the teaching of Calculus at secondary and tertiary level.

The exclusive role of Calculus in science as well as in mathematics education have led to a variety of approaches to research in this area. The Thematic Working Group 25 aims to offer participants this richness of perspectives, to provide opportunities for discussions that may stimulate comparison or integration of perspectives, and to create venues for collaborations on issues of Learning and Teaching Calculus at Secondary Level and at the Transition to the Tertiary level.

Call for papers and poster proposals

We invite research-based papers that discuss empirical, theoretical, methodological, or philosophical issues pertaining to Learning and Teaching Calculus at Secondary Level and at the Transition to the Tertiary level. We welcome papers that address, but are not limited to, the following *foci*:

- Calculus related concepts from Grade 7 to college.
- Students' preparation for learning calculus, including topics such as variable, covariation, graphs, graphical thinking, functional thinking, rates of change, and accumulation.
- The fundamental notions of calculus, including derivative as rate of change, integral as accumulation, differentials, continuous, derivable integrable functions and the fundamental theorem of calculus.
- Extra-mathematical contexts for learning calculus as well as the notions of calculus as they are being used outside of mathematics proper, for example in-service courses addressed to non-mathematicians at tertiary level, teaching in other disciplines at secondary school, or modelling.
- Calculus as preparation for further mathematical development such as the idea of differential equation.
- Calculus as a discipline that is different from analysis.

The above examples, as well as other issues, will be considered from a range of viewpoints:

- Historical, philosophical, epistemological, disciplinary, and interdisciplinary.
- Cognitive, affective, embodied, multimodal, social, and cultural.
- Technological, including computer science and artificial intelligence.
- Educational, focused on student engagement, intervention design, teacher enactment of argumentation and proving in classrooms.
- Curricular, considering the role of Calculus in curricular and policy resources.

Papers and poster proposals *must use the CERME template*, and conform to the guidelines at <https://www.cerme14.it/>. CERME 14 uses an electronic submission system <https://www.conftool.pro/cerme14/>. The authors submit the initial version of their paper on the website (uploading it both as a .doc and a .pdf file, and providing the required information, in particular the TWG number).

Reviews and decisions

Each paper will be peer-reviewed by two persons from among those who author papers to this TWG. *All co-authors* can be asked to review up to two papers. The group leaders will decide about the acceptance of posters.

Important dates

- See <https://www.cerme14.it/> for important dates.