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## **Workshop**

### **APPROACHING CONIC SECTIONS WITH MATHEMATICAL MACHINES AT SECONDARY SCHOOL**

Michela Maschietto

University of Modena e Reggio Emilia

In secondary and tertiary educations, students study conic sections mainly as algebraic objects with a graphical representation. They rarely meet conic sections from a synthetic point of view. In addition, the origin of conics - as curves obtained by cutting a cone with a plane - has become a sort of “simple story” to introduce them, but this is not always picked up by the teachers during the lessons. In Italy, the recent reform of secondary school education requests to develop a synthetic approach to geometry.

This workshop aims to discuss the main steps of a teaching experiment focusing on the introduction of conic sections at secondary school level (16-17 years-old students) following the methodology of mathematics laboratory with mathematical machines (Maschietto & Martignone 2008, Maschietto & Bartolini 2011). In this teaching experiment the historical dimension is very important, because each mathematical machine has a strong link with the history of mathematics (Bartolini Bussi, 2005). In particular, we have considered mathematical machines with tightened threads and articulated antiparallelograms (described in Van Schooten’s books), big models of cones cut by a plan representing Apollonius’s theory and big models showing Dandelin’s theorem (all are available at the Laboratory of Mathematical Machines in Modena, [www.mmlab.unimore](http://www.mmlab.unimore)).

The workshop is organised in steps as follow:

1. Introduction to mathematics laboratory with mathematical machines and to the context of the teaching experiment;
2. Working group on the analysis of worksheets for students concerning a first mathematical machine;
3. Collective discussion;
4. Working group on a second mathematical machine;
5. Collective discussion and historical perspective;
6. Working group on a third mathematical machine;
7. Presentation of the final step of the teaching experiment.

Participants: secondary school teacher, researchers.

Age of students involving in the teaching experiment: 16-17 years.

Materials for the participants: worksheets, historical texts, outline of the teaching experiments, mathematical machines.

## References

- Bartolini Bussi, M.G. (2005). The meaning of conics. In: J. Kilpatrick, C. Hoyles, O. Skovsmose & P. Valero (Eds.) *Meanings in Mathematics Education*, 39-60. Springer.
- Maschietto, M. & Bartolini Bussi, M.G. (2011). Mathematical Machines: from History to the Mathematics Classroom. In: P. Sullivan and O. Zavlasky (Eds.) *Vol. 6 Constructing knowledge for teaching secondary mathematics: Tasks to enhance prospective and practicing teacher learning*, 227-245. New York: Springer.
- Maschietto, M. & Martignone, F. (2008). Activities with the mathematical machines: pantographs and curve drawers. In: E. Barbin, N. Stehlikova and C. Tzanakis (Eds.), *History and Epistemology in Mathematics Education: Proceedings of the fifth European Summer University*, 285-296. Prague: Vydavatelsky Press.