

## ANALYSIS OF ALGEBRAIC REASONING AND ITS DIFFERENT LEVELS IN PRIMARY AND SECONDARY EDUCATION

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### Short description of the workshop: aims and underlying ideas

*An important objective in various curricular guidelines (e. g., NCTM, 2000) is the enhancement of algebraic reasoning since the first educational levels. This objective implies that we assume a new view of school algebra as being not limited to handling algebraic expressions (Aké, Godino, Gonzato & Wilhelmi, 2013; Godino, Ake, Gonzato & Wilhelmi, 2014). The effective implementation of this new conception of school algebra poses a challenge for the training of mathematics teachers, because few current training programs include the development of such new vision.*

*The objective of the workshop is to implement some practical activities aimed at recognizing the main features of School Algebraic Reasoning (SAR), which can be used to train teachers to promote algebraic thinking in primary and secondary education. The wider view of school algebra that will be presented and discussed takes into account the processes of generalization, symbolization, as well as structural and functional modelling and analytical calculation. It also creates a meaningful link between algebraic thinking in primary and secondary education.*

### Planned structure

Planned timeline	Topic	Material / Working format / presenter
Module 1 (45 minutes)	Introducing the workshop and discussing the Proto-Algebraic Reasoning for Elementary Education model.	Aké, L., Godino, J. D., Gonzato, M. & Wilhelmi, M. R. (2013).  Presenter: Juan D. Godino & Teresa Neto
	Practical Activity 1	Working in teams to perform the following tasks:  i) Solving a selected set of tasks on School Algebraic Reasoning (Part I). ii) Assigning levels of algebraic thinking to different solutions given to the tasks by taking into account the previously identified algebraic objects and processes. iii) Enunciating related tasks whose solution involves changes in the levels of algebrization.  Presentation and discussion of results.

<p>Module 2 (45 minutes)</p>	<p>Discussing the model of Algebraic Reasoning for Secondary Education.</p>	<p>Godino, J. D., Neto, T., Wilhelmi, M. R., Aké, L., Etchegaray, S. &amp; Lasa, A. (2015).  Presenter: Juan D. Godino &amp; Teresa Neto</p>
	<p>Practical activity 2</p>	<p>Working in teams to perform the following tasks:  iv) Solving a selected set of tasks on School Algebraic Reasoning (Part II). v) Assigning levels of algebraic thinking to different solutions given to the tasks, taking into account the previously identified algebraic objects and processes. vi) Enunciating related tasks whose solution involves changes in the levels of algebraization.  Presentation and discussion of results.</p>

After discussing two main references about SAR, the attendees will be asked to solve a set of tasks with the aim of identifying the algebraic objects and processes put at stake, and recognizing the different algebraization levels involved in the mathematical activity carried out when solving these tasks.

### References

- Aké, L., Godino, J. D., Gonzato, M. & Wilhelmi, M. R. (2013). Proto-algebraic levels of mathematical thinking. In Lindmeier, A. M. & Heinze, A. (Eds.). *Proceedings of the 37th Conference of the International Group for the Psychology of Mathematics Education*, Vol. 2, pp. 1-8. Kiel, Germany: PME.
- Godino, J. D., Neto, T., Wilhelmi, M. R., Aké, L., Etchegaray, S. & Lasa, A. (2015). Levels of algebraic reasoning in primary and secondary education. In K. Krainer & N. Vondrová (Eds.) (2015). *Proceedings of the Ninth Conference of the European Society for Research in Mathematics Education (CERME9, 4-8 February 2015)* (pp. 426-432). Prague, Czech Republic: Charles University in Prague, Faculty of Education and ERME TWG 03: Algebraic Thinking.
- National Council of Teachers of Mathematics (NCTM) (2000). *Principles and standards for school mathematics*. Reston, VA: Author.