Tuesday 24 July 2018, 10:30-11:00
Room: PA 113

Proposal id: **66**

Uffe Thomas Jankvist
Aarhus University, Denmark
utj@edu.au.dk

Mario Aguilar
Instituto Politécnico Nacional, Mexico
mario.sanchez@me.com

Morten Misfeldt
Aalborg University, Denmark
misfeldt@learning.aau.dk

Tschirnhaus' transformation: mathematical proof, history and CAS

Abstract

The paper addresses the potential of using history of mathematics in combination with ICT to illustrate the notion of proof and proving to (undergraduate) students and relates such use to research findings regarding students' difficulties with proofs and proving (e.g. Dreyfus, 1999; Duval, 2007) as well as the role of counter-examples in relation to mathematical proof. In relation to the use of ICT, the paper draws on the instrumental genesis (Trouche, 2005), the distinction between epistemic and pragmatic mediations (Artigue, 2002), and Nabb's (2010) model for use of CAS in mathematics education.

Based on Alibert's (1988) construct of generating so-called scientific debates in the classroom, the paper outlines a teaching and learning activity, where CAS may play the role of a 'white box' and an epistemic mediation in relation to the notion of proof. The historical case used to illustrate this is Tschirnhaus' transformation from 1683, suggesting a presumed method for solving *n*-degree algebraic equations, drawing also on the correspondences between Leibniz and Tschirnhaus' concerning this transformation. From this point of view, CAS comes to support and illustrate Leibniz' arguments for the students.

Keywords: History of mathematics, original sources, CAS, mathematical proof.

References

Alibert, D. (1988). Towards new customs in the classroom. *For the Learning of Mathematics*, **8**(2), 31-35.

Artigue, M. (2002) Learning mathematics in a CAS environment: the genesis of a reflection about instrumentation and the dialectics between technical and conceptual work. *International Journal of Computers for Mathematical Learning*, **7**(3), 245–274.

Dreyfus, T. (1999). Why Johnny can't prove. *Educational Studies in Mathematics*, **38**(1-3), 85–109.

Duval, R. (2007). Cognitive functioning and the understanding of mathematical processes of proof. In: P. Boero (Ed.) *Theorems in school: From history, epistemology and cognition to classroom practice* (pp. 137-161). Rotterdam: Sense Publishers.

Nabb, K. A. (2010) CAS as a restructuring tool in mathematics education. In: P. Bogacki (Ed.) *Electronic Proceedings of the 22nd International Conference on Technology in Collegiate Mathematics* (pp. 247-259). Retrieved from: http://archives.math.utk.edu/ICTCM/v22.html

Trouche, L. (2005). Instrumental genesis, individual and social aspects. In: D. Guin, K. Ruthven & L. Trouche (Eds.), *The Didactical Challenge of Symbolic Calculators: Turning a Computational Device into a Mathematical Instrument* (pp. 197–230). New York, NY: Springer.

von Tschirnhaus, E. W. (1683). *Methodus auferendi omnes terminos intermedios ex data æquatione*.

==========