

ZMATH 2016f.01070

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Using a digital tool to improve students' algebraic expertise in the Netherlands: crises, feedback and fading.

Pope, Sue (ed.), Proceedings of the British Society for Research into Learning Mathematics (BSRLM). Proceedings of the British congress of mathematics education, BCME-8, University of Nottingham, UK, April 14–17, 2014. London: British Society for Research into Learning Mathematics (BSRLM). 25-32 (2014).

Summary: Enhancing ways of developing students' algebraic expertise remains an important focus for research. This paper reports on a design research study which involved a digital intervention for 17–18 year old students, implemented in nine schools in the Netherlands ($N = 324$). For the intervention, algebra tasks for the conceptual and procedural components of algebraic expertise were placed in a sequence based on three design principles: (i) 'crisis' items that intentionally questioned the use of standard algorithms, (ii) feedback provided by the digital system, and (iii) the 'fading' of feedback during the sequence to increase transfer. Data collected included results from student pre- and post-tests, questionnaires, and scores and log files of their digital work. Results from the study show that the intervention was effective in improving algebraic expertise, and that the aforementioned design principles have merit. This paper reports on the effects and illustrates the design principles through a case example. The intervention shows a significant effect in improving algebraic expertise. It shows that well-thought-out design principles augment learning. The paper fits in a broader discussion on how to integrate algebraic expertise and ICT use in the classroom through the use of educational design.

Classification: H20 U70 D40

Keywords: elementary algebra; design research; teaching; educational research; algebraic expertise; digital intervention; design principles; educational design; pre-crisis items; crisis items; post-crisis items; problem posing; ICT; feedback; computer as educational medium

<http://www.bsrlm.org.uk/BCME8/BCME8-04.pdf>