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Linear equations :grade 9 learners' progress and their difficulties over time

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2019

https://hdl.handle.net/10539/29448

Halley, Andrew Graham. (2019). Linear equations: Grade 9 learners' progress and their difficulties over time. University of the Witwatersrand, https://hdl.handle.net/10539/29448

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Abstract

This study investigated Grade 9 learners' progress in solving linear equations over a six month period. The notion of progress is taken to encompass shifts in learners' abilities to solve equations with fluency, and shifts in communicating their reasoning, Data were collected with six learners in a Johannesburg secondary school, by means of four task-based interviews each. The interviews provided periodic glimpses into learners' progress. The interview instrument was a unique task-matrix, which made provision to move flexibly between different linear equations to explore shifts in learners' abilities to solve the equations and in their reasoning. The data analysis focussed on describing learners' progress, the approaches they used in solving linear equations, the difficulties they encountered and resulting errors. Three notable difficulties emerged: the didactic cut (the transition from arithmetic to algebraic equations), difficulties with negativity and difficulties with items of the form $ax = bx$. A key contribution of the study is the closing analysis which accounts for some of the difficulties and successes in the transition from arithmetic to algebraic equations by drawing on the Vygotskian notions of spontaneous and scientific concepts and the zone of proximal development. The findings of the study suggest the need to be aware of the existence and persistence of the didactic cut for some learners, the difficulties which negativity brings and the case of $ax = bx$ which learners treated as a different type of equation.