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Developing additive relations word problem solving with the use of relational models

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ABSTRACT

Two issues reported in the literature relating to South African learners' solving of additive relations word problems informed the adoption of a relational model-based approach for the design and implementation of this intervention study. The first issue relates to evidence that learners struggle to set up models of word problem situations that adequately express the sense they make of additive situations. The other relates to evidence of challenges in moving learners beyond the use of rudimentary counting strategies when calculating additive tasks. Given the evidence of both of these issues in the early grades in South Africa, I designed and implemented a relational model-based approach that orchestrates a problem-solving cycle that links models of situations and models of number. The need for designing such an approach was informed by a view of word problem-solving as a cycle involving two critical phases – an interpretation phase in which models of the situation are set up, and a calculation phase in which a model of number is used to calculate the answer – and a third, less critical, evaluation phase in which the answer is rendered discernible as such. To feed this need, I adopted the *Relational Paradigm* as a theoretical base whilst incorporating elements from Realistic Mathematics Education (RME) for both the design of the intervention and the analysis of the data. The *Relational Paradigm* refers to learning and teaching approaches that distinguish between the interpretation phase of the word problem-solving cycle, which involves the construction of a model of the situation described in the problem, and the calculation phase which involves the execution of the chosen operation based on the model of the situation described in the problem, thus making it possible for deliberate attention to be paid to either or both of the two critical phases of word problem-solving, for research and teaching purposes. The RME elements incorporated into the design and implementation of this study related to harnessing the sequential structure of number in order to promote the use of ten-based strategies that can be modelled as jumps on an empty number line.

Findings from this study point to the potential of this relational model-based approach to effect improvements in performance underpinned by improved interpretations of different word problem situations into models (mostly into bar models), and a move away from count-by-one strategies to calculation that makes use of the sequential structure of the number line with ten as a benchmark.

Key words: additive situations; additive relations word problems; relational model-based approach; models of situations; models of number; bar diagrams; empty number lines.

Appendix: detailed descriptions of intervention lessons