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Subtraction by addition : Potentialities and barriers of the use of a clever calculation strategy

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Lieven Verschaffel (1957) is professor in educational sciences at the Katholieke Universiteit Leuven, where he teaches “didactics of mathematics and language” and “general didactics”. His major research interests are: Teaching and learning of (mathematical) problem-solving and learning skills, strategy choice and strategy change in (elementary) mathematics, metacognitive and affective aspects of (mathematics) learning, and conceptual change (in mathematics). He is the coordinator of a “Concerted Research Action” (funded by the Research Fund of the K.U.Leuven) “Developing adaptive expertise in mathematics education” and of the International Scientific Network “Stimulating critical and flexible cognitions” (funded by the Fund for Scientific Research – Flanders). He is a member of the “Education Committee” of the European Mathematical Society (EMS).

As a recognition of his significant contribution to the domain of (psychology of) mathematics education, he was recently selected as member of the Belgian Royal Academia for Sciences and Arts.

Résumé de la conférence

Subtraction problems of the type $a - b = .$ can be solved by various strategies, including the “subtraction-by-addition” (i.e., “how much do I have to add to b to get at a ?”). Surprisingly little research has been done on the use of this strategy for solving symbolically presented single-digit (e.g. $13 - 7 = .$) or multi-digit numbers e.g., $81 - 67 = .$). In the present seminar, I will review and discuss the available empirical research on the occurrence, the efficiency, and the adaptivity of people’s (both adults’ and children’s) use of this “subtraction-by-addition” strategy, which is considered a “clever” calculation strategy especially when the difference between the minuend and the subtrahend is small (e.g. $11 - 9 = .$ or $81 - 79 = .$).



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[Résumé de la conférence de L. Verschaffel, suite]

This research involves both ascertaining studies (i.e. studies that have analysed the use of the subtraction-by-addition strategy under given instructional conditions) and intervention studies (i.e. studies wherein children received instruction and practice in that strategy). And, as far as strategy identification is concerned, these studies have used a variety of verbal protocol methods (e.g., thinking aloud, retrospection) and non-verbal data-gathering methods (e.g., reaction-times, contrastive problem presentations...). When trying to explain the obtained results, both factors associated with Piaget's theory of cognitive development and factors related to the participants' (mathematics) educational background will be addressed. I will end with a discussion of some theoretical, methodological, and educational implications of the research being reviewed.

Lecture proposée

Torbeyns, J., De Smedt, B., Ghesquière, P., & Verschaffel, L. (2009). Acquisition and use of shortcut strategies by traditionally schooled children.

Educational Studies in Mathematics, 71, 1-17.

Torbeyns, J., Ghesquière, P., & Verschaffel, L. (2009). Efficiency and flexibility of indirect addition in the domain of multi-digit subtraction. *Learning and Instruction*, 19, 1-12.

Verschaffel, L., & Torbeyns, J. (Eds). (2009). Young Children's Understanding and Application of Subtraction-Related Principles (Special Issue).

Mathematical Thinking and Learning, 11(1-2), 1-112.

De Smedt, B., Torbeyns, J., Stassens, N., Ghesquière, P., & Verschaffel, L. (in press). Frequency, efficiency, and flexibility of indirect addition in two learning environments. *Learning and Instruction*.

Peters, G., De Smedt, B., Torbeyns, J., Ghesquière, P., & Verschaffel, L. (in press). Using addition to solve subtractions in the number domain up to 20. *Acta Psychologica*.