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**YOUNG STUDENTS LEARNING ORDER WITHIN FORMAL ALGEBRAIC NOTATION**

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Over the last twelve years there have also been reports of students of primary school age successfully using letters in a meaningful way, although this has been with relatively simple expressions. This study looks at how 9-10 year old students learnt order of operations within complex formal algebraic expressions, on their way to learning to solve linear equations. This was a mixed ability class of 21 students who had never met letters in a mathematical context, nor formal algebraic notation. They were taught over just three lessons using the computer software *Grid Algebra*. The lessons were taught mainly with an interactive whiteboard, although there were also some pencil and paper activities and two sessions in a computer suite. The software is based upon making journeys around a multiplication number grid. Any number can be picked up and dragged horizontally (resulting in addition or subtraction within a multiplication table) or vertically (multiplication or division between multiplication tables) on the grid with the process, rather than the resulting answer, shown in formal notation. For example the number 3 sitting in the one times table can be dragged four spaces to the right, resulting in 3+4. This expression can then be dragged down to the two times table row, resulting in 2(3+4) being shown. This meant that students had at least two potential meanings for an expression, an arithmetic meaning where 2(3+4) is seen as a mix of addition and multiplication; and a visual meaning, there 2(3+4) is seen as a mix of moving across and moving down. It is the dynamic of these two spaces which is the focus of this report. Fauconnier and Turner (2002) talk about a blended space where two or more spaces are brought together which can help develop a new structure. Here the blended space of arithmetic operations and physical movements operated together. In the early stages of meeting formal notation through movements on the grid there was evidence of students becoming confused between the arithmetic and the visual meanings. However, later on, a number of students were able to focus purely on the visual dynamics of creating expressions through movement which helped them successfully learn order of operations, which was then transferred into arithmetic meanings when they later began solving linear equations.

**References**
