Rigour and Vocabulary (contributor: Chris Linsell)

How does Grid Algebra help students to show rigour and correct use of vocabulary?

We believe that it is important to be explicit to students about the conventions we are using, and not simply to assume that they will know about them. I have talked to a number of students who believe that 3n means thirty something.

Algebraic notation differs slightly from the arithmetic notation that students are used to in a relatively small number of ways. The × symbol is omitted between factors and the ÷ symbol is not used in expressions. Instead of the ÷ sign, much greater use is made of the vinculum for algebraic fractions. Grid Algebra adopts exactly the same notation for division for both algebraic and arithmetic expressions, and hence provides a seamless transition between the two.

When writing expressions on the board it is therefore important to set them out correctly and clearly. One of Dave Hewitt's principles is that one should always follow correct order of operations when writing on the board, rather than writing from left to right. For example, if writing 3(x + 2) start by writing x, then + 2, and then put the brackets round the expression, and finally write up the 3.

When I ask students to tell me an answer to a problem that is an algebraic or arithmetic expression, I write exactly what they say on the board. Often students have something different on paper or in their heads compared to what they say. For example a student may say, "three plus four times two" when they mean (3 + 4) × 2, but be completely happy when I write 3 + 4 × 2 on the board. When I evaluate the expression as 11 they are likely to say that it should be 14. Students often believe that one can arbitrarily put brackets round parts of expressions when evaluating, rather than evaluate exactly what is written. Writing exactly what students say also encourages good communicative mathematical language, e.g. three plus four, pause, all multiplied by two.

Algebra Everywhere (contributor: Chris Linsell)

How does Grid Algebra help students to see that algebra is everywhere?

Students often perceive algebra as abstract, useless and not connected to real life or the apparently more useful work they have done in Number. Focusing on mathematical structure allows clear connections to be made between arithmetic and algebra, as arithmetic structure is identical to algebraic structure. The difficulty is to find good learning experiences that develop students' appreciation of arithmetic structure, and that allow a seamless transition to algebraic structure. Grid Algebra provides such an opportunity. As students focus on interpreting and writing arithmetic expressions, lessons can be developed that push generalization of the ideas and that give students confidence in working with algebraic expressions.

Toolbox – reading and writing notation (contributor: Chris Linsell)

How does Grid Algebra help students to add reading and writing notation to their toolboxes?

The key idea I worked on using Grid Algebra was mathematical structure. I have always been concerned that the algebra that we teach at secondary school relies heavily on an understanding of mathematical structure, but that students very rarely have much prior experience of working with arithmetic structure, other than combining two quantities or adding up a column of figures. I believe that a few lessons on BEDMAS is often perceived by students as being an idiosyncrasy of mathematicians to be learnt as yet another rule, rather than an introduction to mathematical structure. Another problem for me has been that I have found it difficult to find many authentic mathematical experiences that teach students about arithmetic structure, prior to working with algebraic structure (which they usually do at the same time as dealing with unknowns or variables).

Context (contributor: Chris Linsell)

How is Grid Algebra engaging context for learning?

Grid algebra provides an opportunity to engage with mathematical structure, initially without any algebraic terms. While it is clearly not a real life context, it is a learning experience that students engaged in intellectually, visually and physically and that they clearly enjoyed.