A Powerful Visual Model for Number and Place-value: The 4-group

Thursday, April 26th, 2012. 10:30am-12:00pm; Salon G, Marriott Downtown.

What does a 4-group have to do with our base-ten number system? Come see how this alternative visual model for conceptualizing the quantity of a number; a model which remains consistent across place-values, creates opportunities for all students to confidently engage in Reasoning and Sense Making.

The 4-group model can be adapted to any preschool or elementary math curriculum.
Learn how to apply it in your classroom.

The workshop will cover:
- number sense
- addition and subtraction
- multi-digit addition and subtraction
- basic fractions
- multiplication

Mathematics education has risen to the top of the national policy agenda as part of the need to improve the technical and scientific literacy of the American public. However, we continue to see problems that prevent our children from becoming competent and comfortable with math. These include:

- Regardless of how much experience they have with common manipulative models, many children are not learning the mathematics they need or are expected to learn.[1]
- Some children do not automatically develop memory representations for basic arithmetic facts, even after years of using counting or other types of strategies.[2]
- Some children in grades 4 to 10 are still counting on their fingers, making marks to count on, or simply guessing at answers.[3]

Lynn Kuske, founder of 4-group Math™ (originally known as Kuske Math™), while working in classrooms observed how some students were not grasping foundational math concepts. These students became frustrated and would then assume that they were incapable of learning or just "didn't get math".
Lynn began developing her new and unique visual/kinesthetic methodology and found it helped to instill math confidence in <u>all</u> children.

4-group Math™ is the first method of its kind that uses The Original 4-Group Method™, a unique set of 4-group Number Patterns, to leverage what the child's brain already has the ability to do — *subitize*.
Subitize is generally defined as the rapid, accurate, and confident judgment of the quantity of a set of objects, without counting. Young children can subitize four objects in a square array, but they cannot subitize linear arrays greater than three.[4] 4-group Math™ capitalizes on this innate ability so all children can conceptualize and manipulate a quantity, based on this square 4-group.

[1] Kenney and Silver, 1997; Mullis et al., 1997, 1998; Beaton et al., 1996 as cited in National Council of Teachers of Mathematics (2000). <u>Principles and Standards for School Mathematics</u>. Reston, VA: National Council of Teachers of Mathematics.
[2] Geary, D. C. (1994). <u>Children's Mathematical Development: Research and Practical Applications</u>. Washington DC: American Psychological Association.
[3] Van de Walle, J. A. (1998). <u>Elementary and Middle School Mathematics: Teaching Developmentally.</u> New York: Longman.
[4] Fischer, J. -P. (1992). Subitizing: The Discontinuity After Three. In J. Bideaud, C. Meljac and J. P. Fischer (Eds.), <u>Pathways to Number</u> (pp. 191-208). Hillsdale, NJ: Lawrence Erlbaum Associates.

Common manipulative models 🐞🐞🐞🐞🐞🐞🐞🐞🐞 used for math require children to count because their linear or random arrangements are not subitizable. If children miscount, they may not realize they are inaccurate. They have no way to check except to count again.[5]

In contrast, the 4-group Number Patterns are made up of four subitizable component parts (the patterns 1,2,3,4). Therefore, children can accurately and confidently see the quantity.

4-group Number Patterns
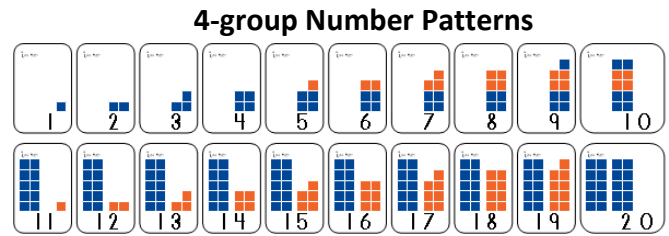
Common manipulative models used for math are not additive, as shown below; they don't fit together to form the pattern for their sum. This requires children to rely on counting to arrive at solutions. If children miscount, they may not realize they are inaccurate. They have no way to check except to count again.
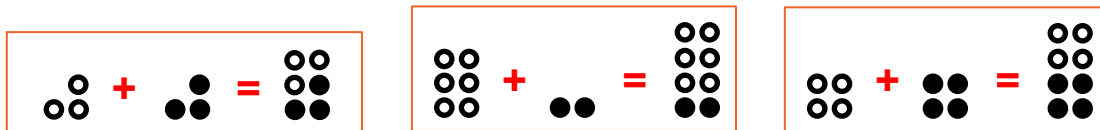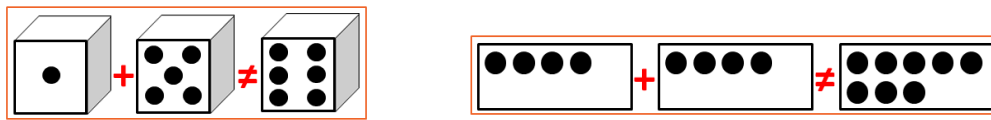
The 4-group Number Patterns are additive, as shown above; they fit together to form the pattern for their sum. This allows children to use their *math eyes* to arrive at solutions. If children count, they have a way to self-check their count and know with accuracy and confidence that their answer is correct.

Math education is in a crisis today!
A math disease appears in 3 grade and children have not been immunized.

To live up to the Equity and Learning Principles of the NCTM we must revisit our visual models.

The Equity Principle--Excellence in mathematics education requires equity—high expectations and strong support for all students (NCTM, 2000, p. 11).

The innate ability to subitize four objects in a square pattern without counting is equally present in all students. Regardless of what they bring to school in the way of previous math experience, students receive math instruction based on this equal footing.

The Learning Principle--Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge (NCTM, 2000, p. 11).

Being innate, subitizing qualifies as prior knowledge.
The 4-group Number Patterns then build on themselves providing experience for subsequent knowledge and understanding.

[5] Kuske, L.T. (2001). It All Fits Together: Number Patterns that Foster Number Sense in K-2 Students--A Brain Based Model. Master of Arts, Education, Antioch University Seattle, Seattle, WA: Unpublished Thesis.

4-group Addition & Subtraction Model

$2 + 2 = 4$

$1 + 3 = 4$
$3 + 1 = 4$

$4 - 2 = 2$

$4 - 1 = 3$

$4 - 3 = 1$

4-group Multi-digit Addition Models

$8 + 6 = 14$

$1\ 4\ 8 + 1\ 3\ 6$

4-group Multi-digit Subtraction Model

$14 - 8 = 6$

$24 - 8 = 16$

$324 - 78$

$$\begin{array}{r} {}^{0}\!\!\!\not{1}4 \\ {}^{+2}\!-\not{8} \\ \hline 6 \end{array}$$

$$\begin{array}{r} {}^{1}\!\!\!2\not{4} \\ {}^{+2}\!-\not{8} \\ \hline 16 \end{array}$$

$$\begin{array}{r} {}^{2\ 1}\!\!\!3\not{2}\not{4} \\ {}^{+3+2}\!-7\not{8} \\ \hline 246 \end{array}$$

4-group Math™
by **Kuske Math**

4-group Fraction Model

whole	halves	halves	thirds	thirds	fourths	fourths	fifths	sixths	eighths	tenths	twelfths

$\frac{1}{1}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{5}$ $\frac{1}{6}$ $\frac{1}{8}$ $\frac{1}{10}$ $\frac{1}{12}$
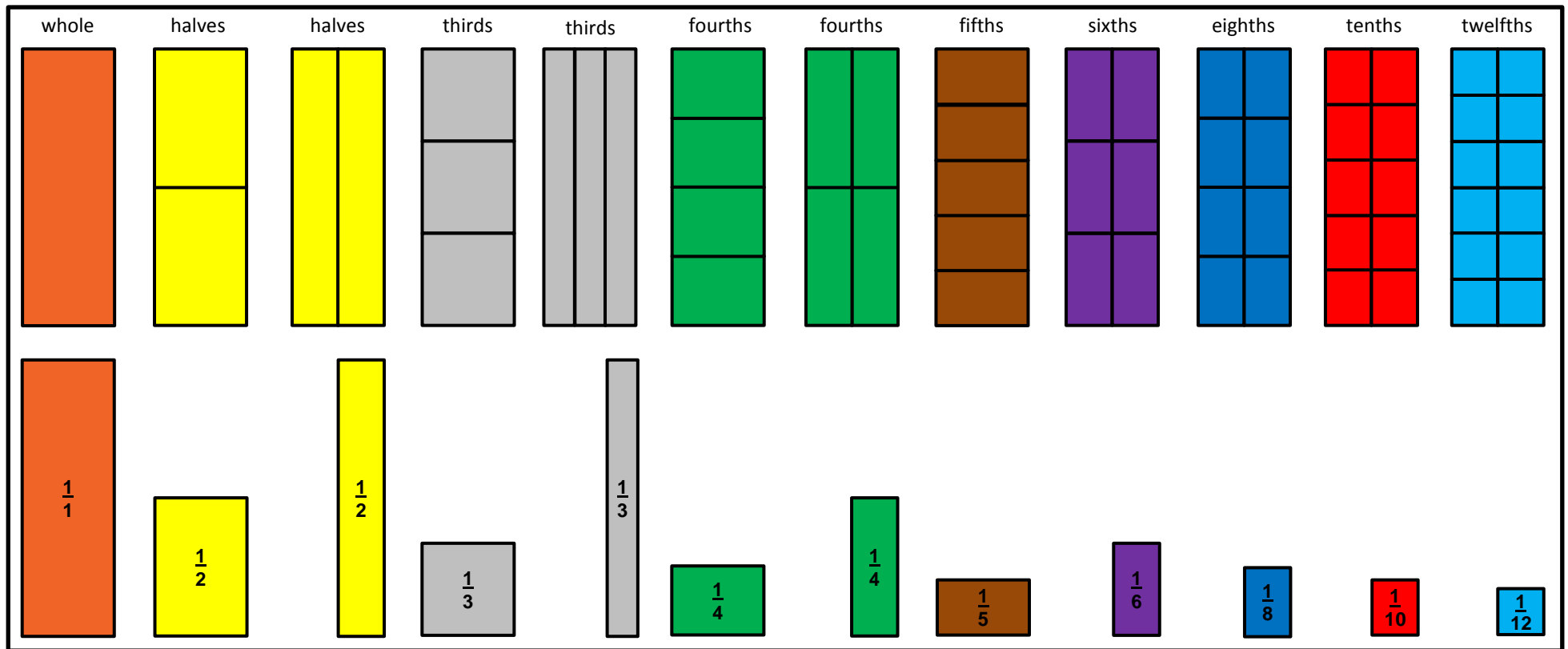
4-group Multiplication Models

2 = 2
2 2 = 4 → 10
2 2 = 4 → 8

$$5 \times 2 = 10$$

$15 \begin{cases} 5 = \\ 10 = \end{cases}$ 5 5 5 $\begin{matrix} 3 & 3 \\ 3 & 3 \end{matrix}$ $\begin{matrix} 3 = 3 \\ = 6 \\ = 6 \end{matrix} \rightarrow \begin{matrix} 15 \\ 12 \end{matrix}$

$$\frac{3}{5} \times \frac{5}{3}$$

or $\frac{3}{5} \times \frac{5}{3}$

$$\frac{2}{4} \times \frac{4}{2}$$

or $\frac{2}{4} \times \frac{4}{2}$