Margi Leech

Maths in action!

Using structured manipulatives to discover relationships in maths and make connections clear

In mathematics and statistics, students explore **relationships** in quantities, space and data and learn to express these **relationships** in ways that help them make sense of the world around them.
NZ Curriculum

What is mathematics?

In mathematics and statistics, students explore relationships in quantities, space and data and learn to express these relationships in ways that help them make sense of the world around them.
NZ Curriculum

What does this mean for teaching?

- Open ended tasks and challenges
- Effective questioning strategies
- Making Skills and Capabilities explicit
- Opportunities to work collaboratively
- More self-directed learning
- Making connections

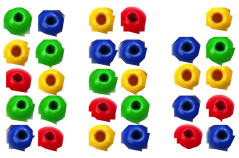
Why is mathematics so difficult to teach and learn?

- Maths involves abstract ideas.
- Maths involves spotting patterns and making generalisations.
- It requires the understanding of number relationships.

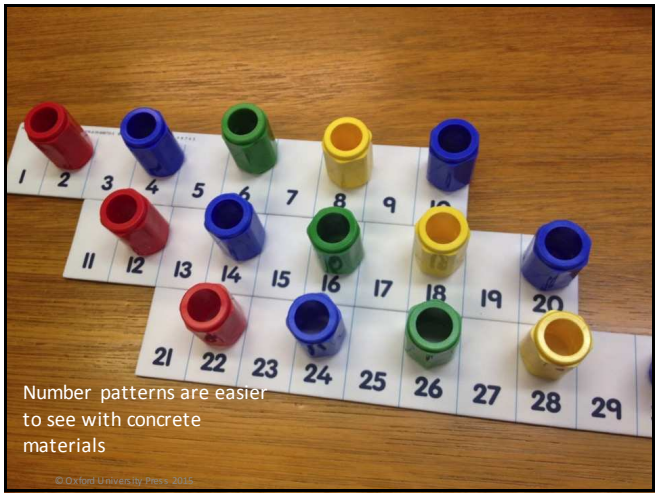
Written numerals and symbols alone do not make this easy...

Counting – a life skill, but clumsy for calculating

Counting



Patterning leading to calculating



Number patterns are easier to see with concrete materials

Multiples of 9

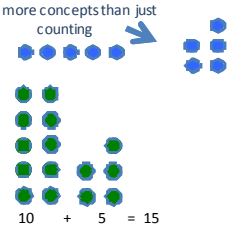
Some key factors influencing mathematical learning

- ability to sequence
- working memory/auditory, visual
- processing
- language skills
- motor skills
- attitude
- teaching approach

Numicon is...

Exploring relationships!

A pattern shows a relationship and more concepts than just counting

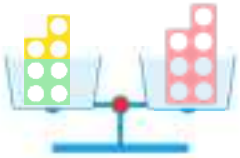


10 + 5 = 15

Structured number representations show many patterns:
odds and evens, +1 and -1, +2 and -2, doubles and halves, x 3 pattern sequence, x 5 pattern sequence, teens, place value, fractions and decimals, negative numbers and more!

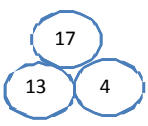
Generalising!

Patterns in number allow us to Generalise.
This enables us to solve problems



The Pan Balance demonstrates equivalence and further relationships of numbers

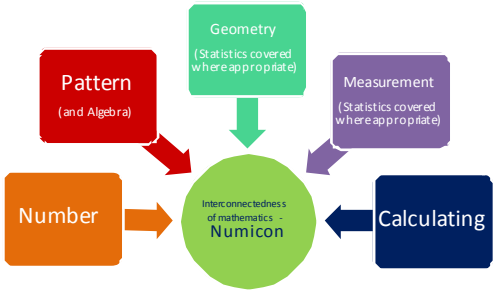
3 + 4 = 7
4 + 3 = 7
7 – 4 = 3
7 – 3 = 4



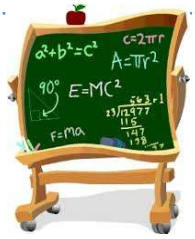
74 + 13 = 87

Communicating mathematically!

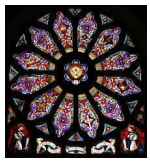
Connections in mathematics



Exploring relationships

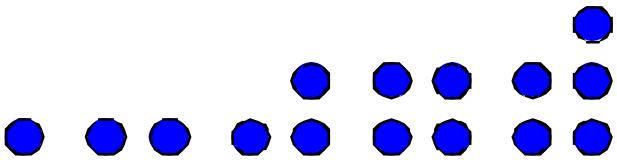


Seeing a pattern is at the heart of mathematical thinking...



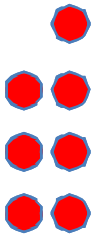
In context...

Constructing meaning for Numicon Shapes



Powerful patterns

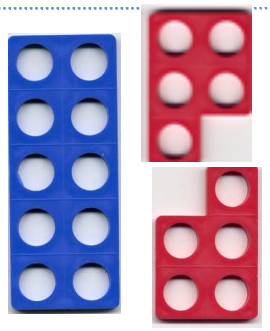
- Opportunity to explore
- Opportunity to talk
- Opportunity to reason
- Attributing their own properties (adjectives) leading to names (nouns) and associations



Structure enables…

- To know a number
- In relationship with others

Talk about all the mathematical ideas you can see



Algebra- patterns of structures

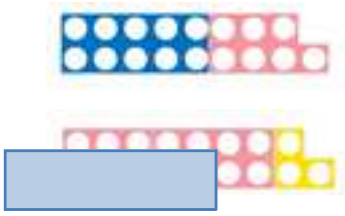
2a + 3 = 17

What is a ?

14 + 3 = 17

7 + 7 + 3 = 17

a = 7



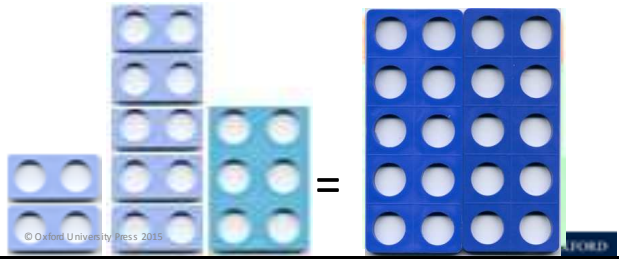
If x = 2

$X_2 + 5x + 6 = (x + 3) \times (x + 2) + 6$

$2_2 + 5(_2) + 6 = (2 + 3) \times (2 + 2) + 6$

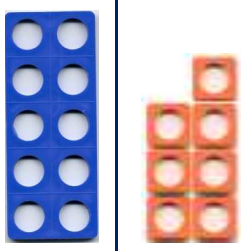
$4 + 10 + 6 = 5 \times 4$

$20 = 20$



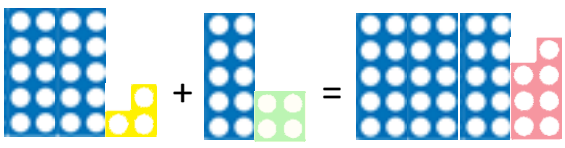
Numbers and the Number system- Place Value

tens	ones
1	7



From Geometry, Measurement and Statistics 4, Teaching Resource Handbook
Geometry 2, Focus Activity 2
Understanding reflective symmetry

Adding and subtracting – higher numbers

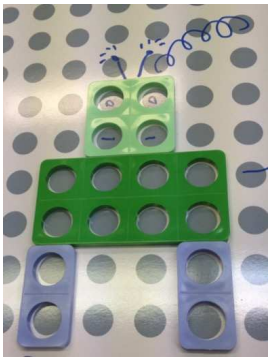


23 + 14 = 37

Multiplication and Division

3 x 15 = 45
15 x 3 = 45

45 ÷ 15 = 3
45 ÷ 3 = 15



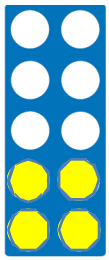
Design an alien with shapes

What is the numerical value of that alien?

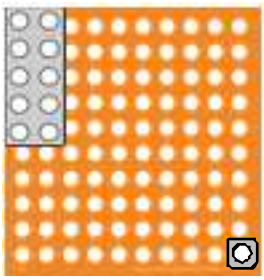
Describe it with an algebraic equation.

Make it compete with another one!

Fractions



$$\frac{4}{10}$$

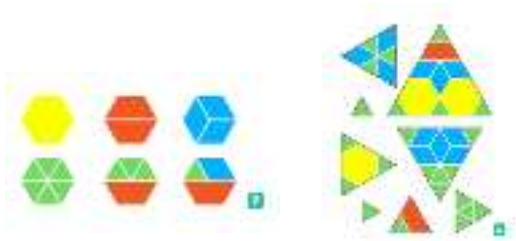


Another alien!

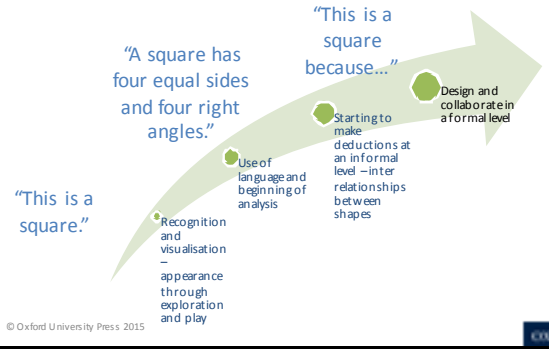
Describe as
- Percentages
- Fractions
- Decimals
- Algebraic expression

What will Numicon look like in our classroom?

Making pictures shapes and patterns



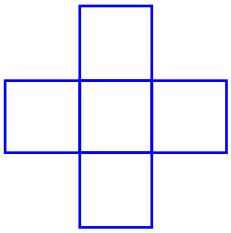
What is GMS with Numicon?



Investigation

Low threshold, high ceiling investigations with Numicon - Cross Totals

- Use Numicon Shapes 1, 2, 3, 4 & 5
- Place one shape in each square so the horizontal and vertical totals are the same
- Discuss any interesting patterns you notice?
- Odds and evens?
- Algebraic expression



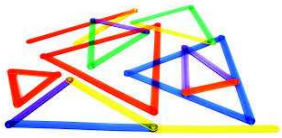
Investigation

Low threshold, high ceiling investigations with Numicon – Six squared

- Mark off six by six on the baseboard template
- Together explore by filling it with your choice of shapes.
- Record what you have done on paper
- Consider multiples, brackets, algebraic expressions

Investigation

Low threshold, high ceiling investigations with Numicon – Investigating polygons GMS 3



Activities to explore

- Making triangle, square, rhombus, pentagon, …
- How does the sequence of the shapes grow? Look at the inside angles.
- Make irregular shapes from the list above

What Numicon can do to make a difference for children!

- Children with learning differences LOVE the visual and hands-on approach
- Children LOVE the problems to solve actively; better than with pen and paper
- Children LOVE being able to talk about their learning and work with a partner and groups
- It's confidence building! A real plus for twice exceptional children

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