Math education in Hungary, K-4

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Brief Background

- Math education in Hungary – historically strong:
  - Boyai, Pólya, Lakatos, Diennes
- 1961 UNESCO meeting in Budapest
  - 'let's teach math for the 21st Century'
- 1964 – 1978 Complex Math Experiment
  - Mathematician Tamás Varga and elementary teachers at the National Pedagogical Institute worked out curriculum
  - Classroom tested
  - Teacher volunteers trained and given ongoing support
- 1978 – 1999 'reform math' was the official curriculum
  - ~66% of teachers worked it competently

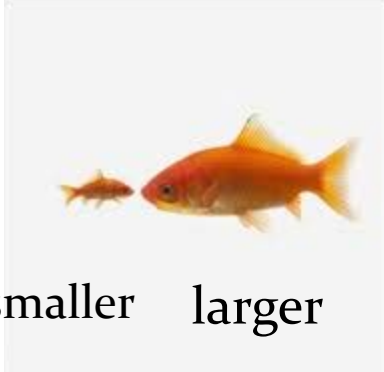
Principles

- Build on informal understanding
- Get children talking and keep them talking
  - Use their ideas to drive the lesson
- Start with the concrete,
  - move to the abstract,
  - add symbols
- Plant the seeds of the big ideas early
  - give them time to mature

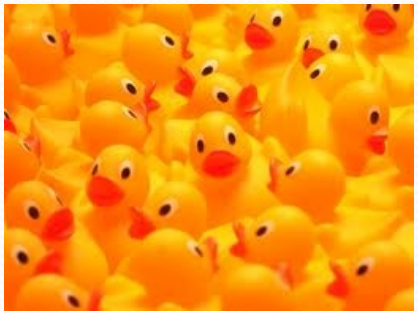
Building on informal understanding

- Ordering things

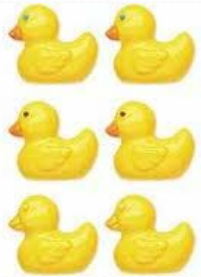
- Relative quantities



smaller larger



more



less

lighter heavier

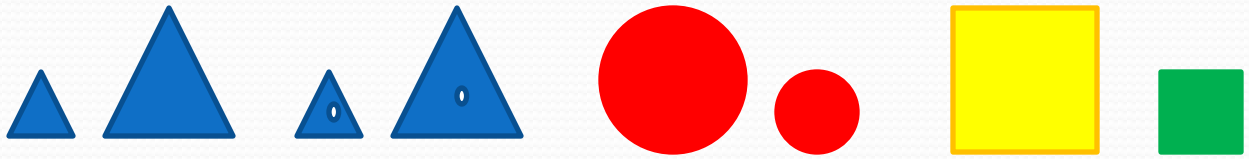
Similar quantities

- Need to be counted
  - To determine a difference

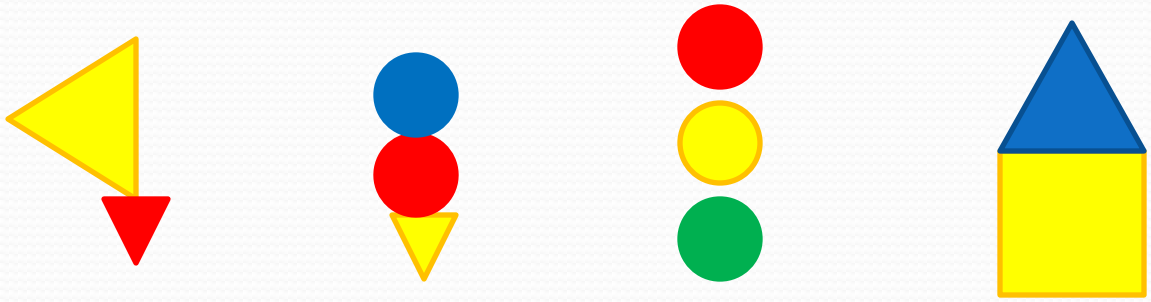
- *So based on the well grounded understanding of inequality,*
  - *introduce* $<$ *and* $>$ *before* $=$

Getting children talking

- Logic tiles – 4 primary colors × 3 shapes × 2 sizes × 2 textures = 48

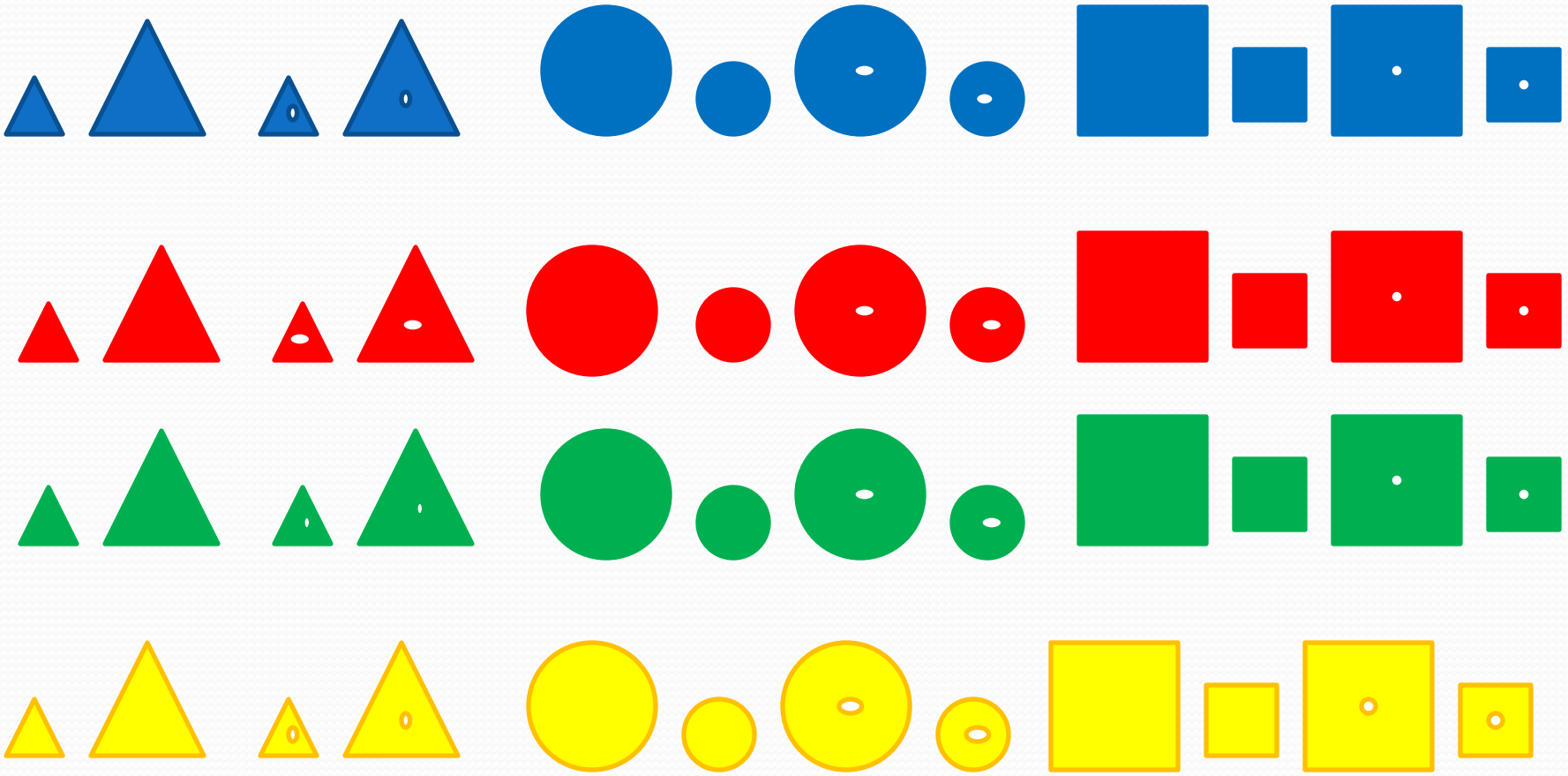


- Describing constructions



- Noticing attributes – games of elimination

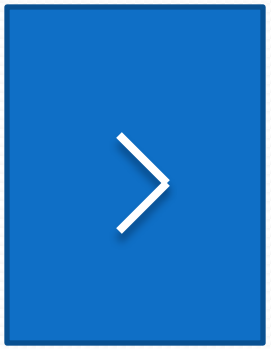
Logic tiles



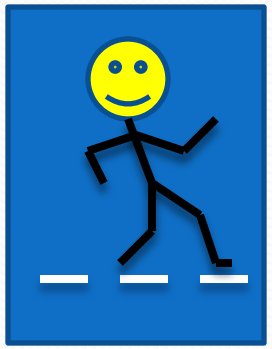
Properties of Numbers (1 – 20)

smaller neighbor

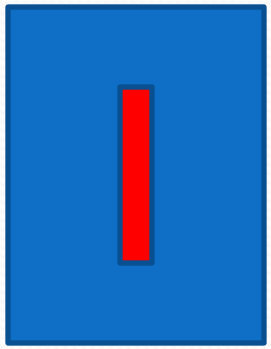
larger neighbor



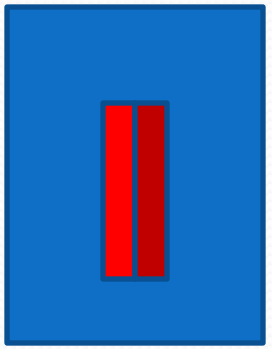
Greater than or less than



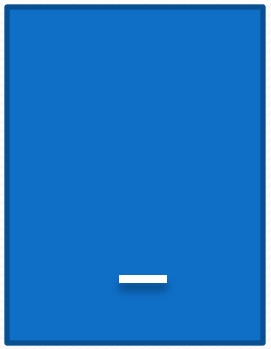
Steps on the # line



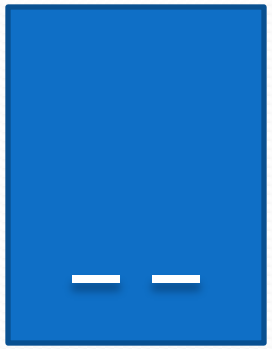
Unpaired (odd)



Paired (even)

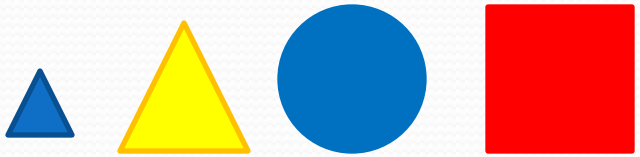


Single digit



Double digit

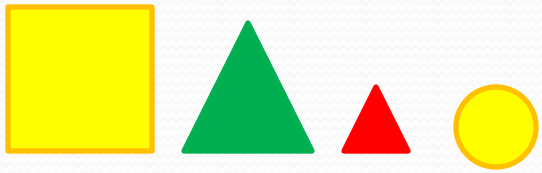
Functions, relations, series

given 

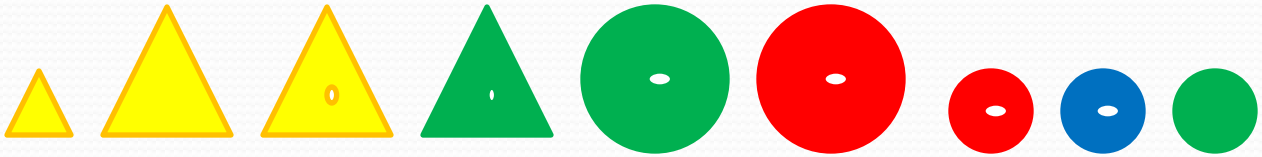
 chosen

given 

 chosen

given 

? chosen



What is next in this series?

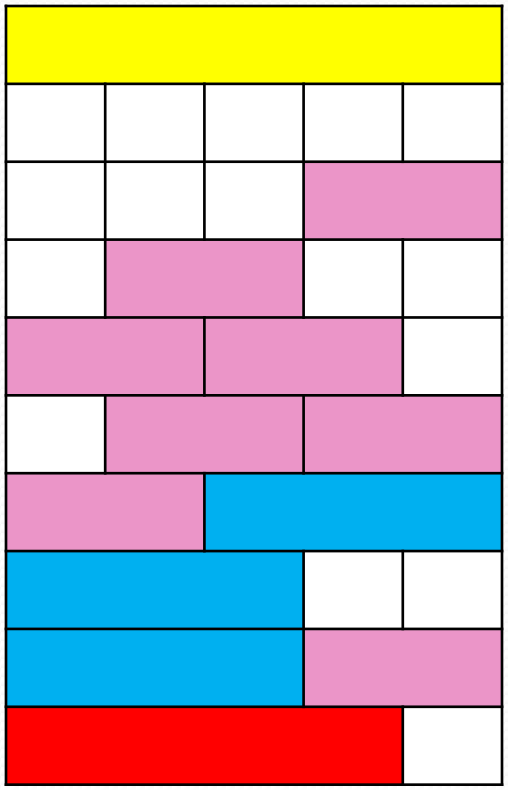
What is the rule?

The many names of a quantity

Mapping cuisenaire rods

Make the yellow length using as many different combinations as possible

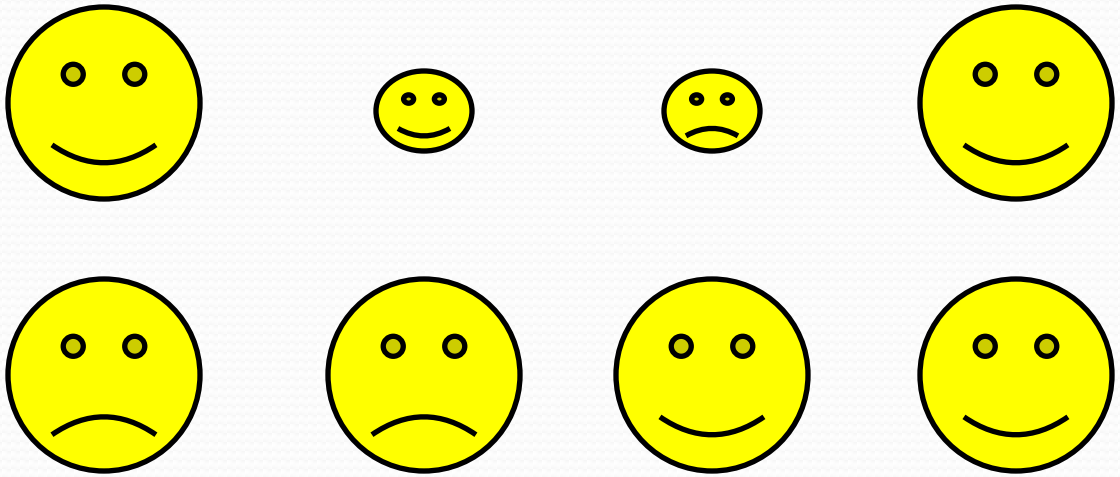
Planting the seeds of addition without using numbers



Teaching specific meanings of operations

Addition: enumerates all pieces, while denoting their different attributes

eg. 2 + 6 (Sm + Lg), 3 + 5 (Sad + Happy), 4 + 4 (arranged in two rows)



Subtraction puts emphasis on some of the pieces:

eg. 8 – 2 (all *but 2* are Lg), 8 - 3 (all *but 3* are Happy), 8 - 4 (all *but 4* are in one row)

Cuisenaire rods - using length to make addition and subtraction meaningful

Find 2 rods that together, make the same length as the burgundy rod
And read off your solutions

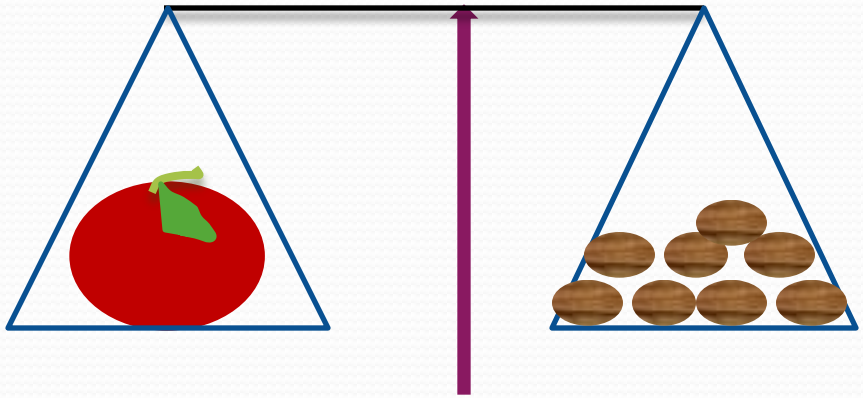
The yellow and blue rods together, are as long as the burgundy rod (5 + 3 = 8)

The burgundy rod is *longer than* a yellow rod by one blue rod (8 = 5 + 3)

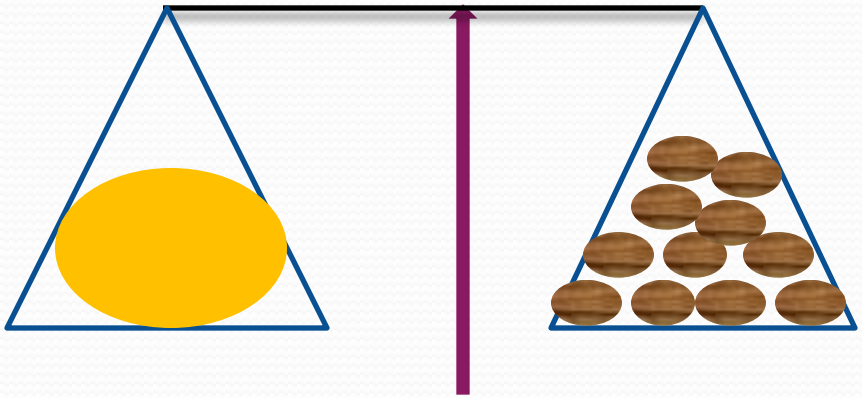
The yellow rod is *shorter than* the burgundy rod a by one blue rod (5 = 8 - 3)

Open ended: several different rod combinations possible

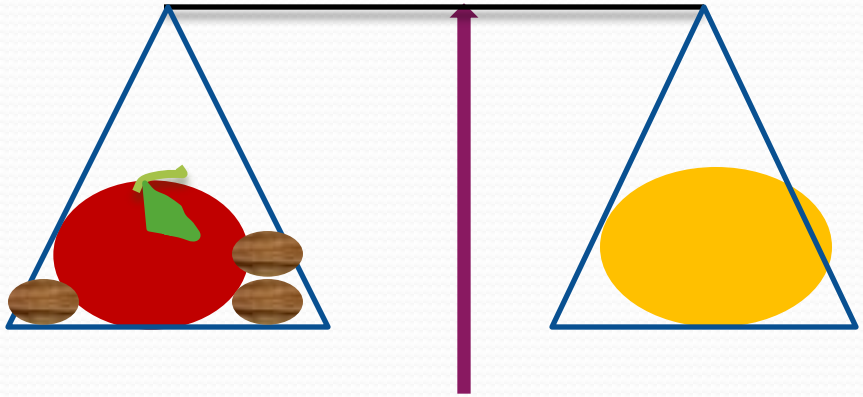
Comparing weights to give addition & subtraction meaning



The apple is balanced
by these many nuts

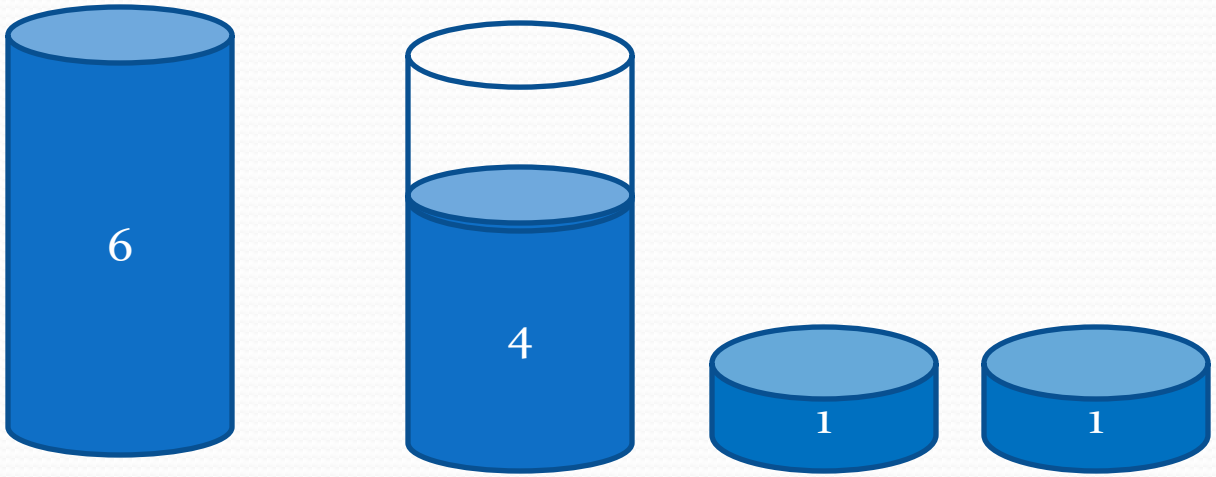


The orange is balanced
by these many nuts



How many fewer nuts are needed to balance the apple than the orange?

Using Volume to reinforce addition and subtraction



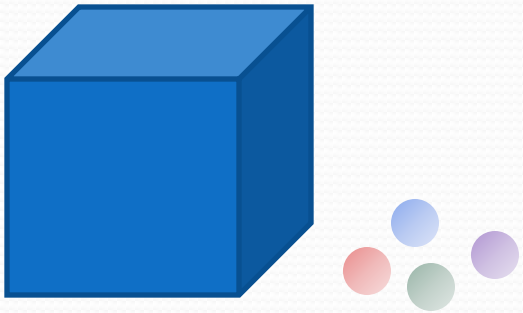
If we add 2 cups of water to the container on the right, both large containers will hold equal amounts 4 + 2 = 6

If we *remove* 2 cups of water from the container on the left, both large containers will hold equal amounts 6 – 2 = 4

Both expressions tell us that the container on the left has 2 more cups of water than the one on the right

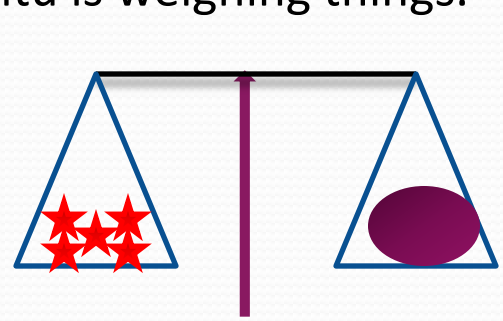
Seeding the idea of the algabreic unknown

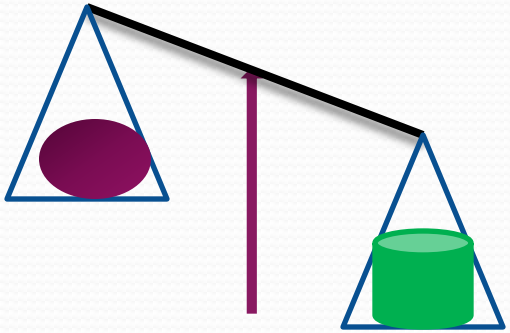
Skemp – part of what is to be counted is hidden

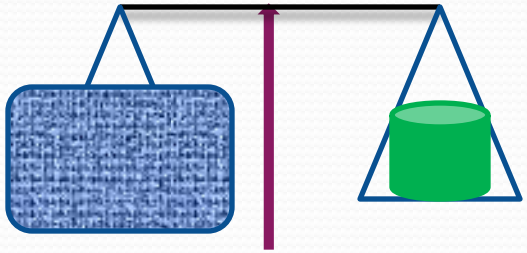


Tony has more than 7 marbles. You can see 4, the rest are in the box. How many can there be in the box?

Ritu is weighing things.



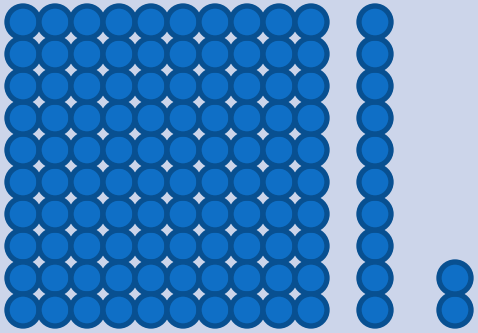
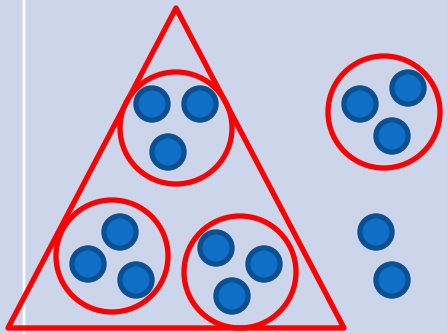




What does her balance show?

How many stars do you think the blue screen hides?

The meaning of place value

Packaging in the base 10 system	Packaging in the base 3 system	Inventory notation		
		# of cases	# of packs	# of units
		1	**1**	**2**

subitization

- Teaches students to recognize small quantities at a glance

- Helps children organize their counting

0 – 4

5 – 8

Intensely oral curriculum

Honing students' ability

- To describe
  - In words
  - With symbols
- To ask better questions
- To connect the physical phenomenon with language and ultimately with mathematics
- To reason – always have to give reasons for the claims they make

Based on the work of

- Tamás Varga
- Eszter C. Neményi

Whose work was heavily influenced by

- Richard Skemp
- Jean Piaget
- Zoltán Diennes