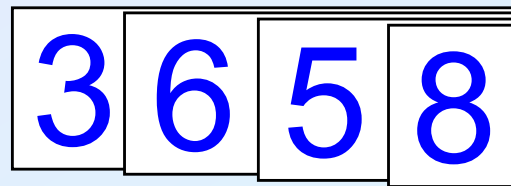


Place Value: The Nucleus of Arithmetic!



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Place Value

- The author of *Treviso Arithmetic of 1478* considered place value so important that it was listed first among the “five” operations of arithmetic.
- It organizes numbers into neat packets.
- Place value is a necessary ingredient to make sense of computational algorithms.
- Without place value, numbers are a string of words that do not identify the values.

Place Value

- Traditional approach through counting:
 $10 + 3$ is a counting process with no incorporation of place value.
- Place value is not memorizing and reciting 1s, 10s, 100s, 1000s.
- The value of a digit's position in a number is not arbitrary, but forms a pattern.
- Place value must be carefully taught.

Place Value

321,987,654,321

| | | | | | | | | | | | |
|-----------------|---|---|-----------------|---|---|-----------------|---|---|-----------------|---|---|
| <i>Hundreds</i> | | | <i>Hundreds</i> | | | <i>Hundreds</i> | | | <i>Hundreds</i> | | |
| <i>Tens</i> | | | <i>Tens</i> | | | <i>Tens</i> | | | <i>Tens</i> | | |
| <i>Ones</i> | | | <i>Ones</i> | | | <i>Ones</i> | | | <i>Ones</i> | | |
| 3 | 2 | 1 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Billions | | | Millions | | | Thousands | | | Ones | | |

Transparent Number Naming

$$10 = \text{ten}$$

$$11 = \text{ten } 1$$

$$12 = \text{ten } 2$$

$$13 = \text{ten } 3$$

$$14 = \text{ten } 4$$

...

$$19 = \text{ten } 9$$

$$20 = 2\text{-ten}$$

$$21 = 2\text{-ten } 1$$

$$22 = 2\text{-ten } 2$$

$$23 = 2\text{-ten } 3$$

...

...

$$99 = 9\text{-ten } 9$$

Transparent Number Naming

3 0 0 0

6 0 0

5 0

8

3 0 0 0

6 0 0

5 0

8

3 6 5 8

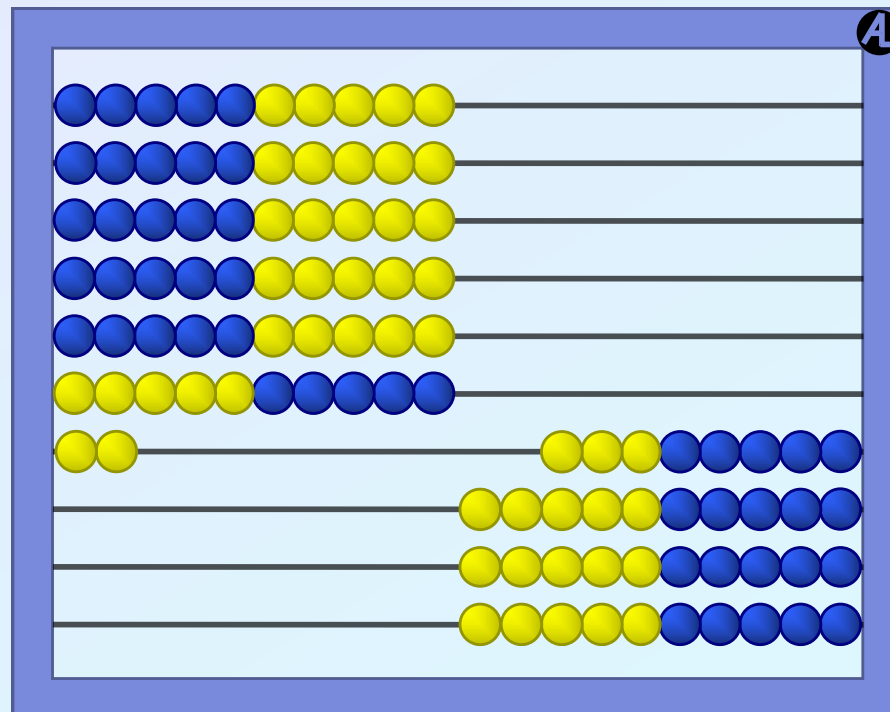
Transparent Number Naming

- Children in Asia learn mathematics using the math way of number naming.
- They understand place value in first grade; only half of U.S. children understand place value at the end of fourth grade.
- Mathematics is the science of patterns. The patterned math way of number naming greatly helps children learn number sense.

Transparent Number Naming and Place Value Cards

6-ten 2

6 2



Can You Find Activity

*Can you find
6 hundred?*

2 hundred 5?

3-ten 9?

8 hundred 46?

600

205

39

846

3000

80

500

2

2000

90

20

60

7

400

700

1

1000

8

100

3

70

300

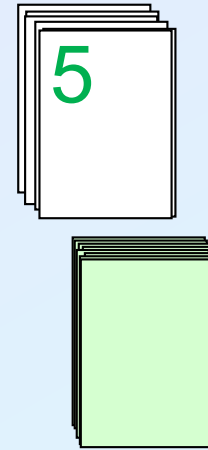
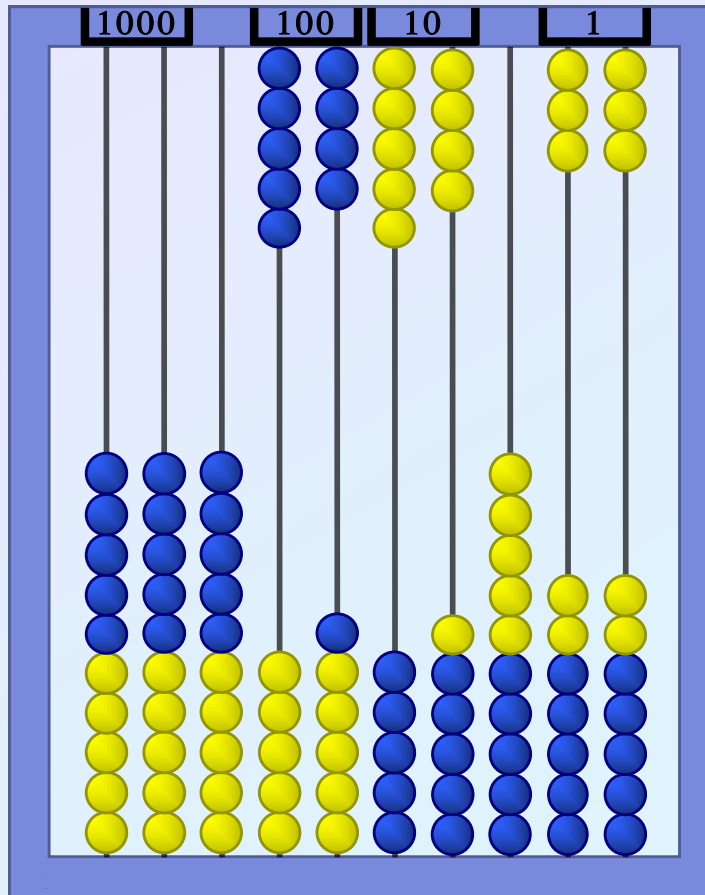
50

900

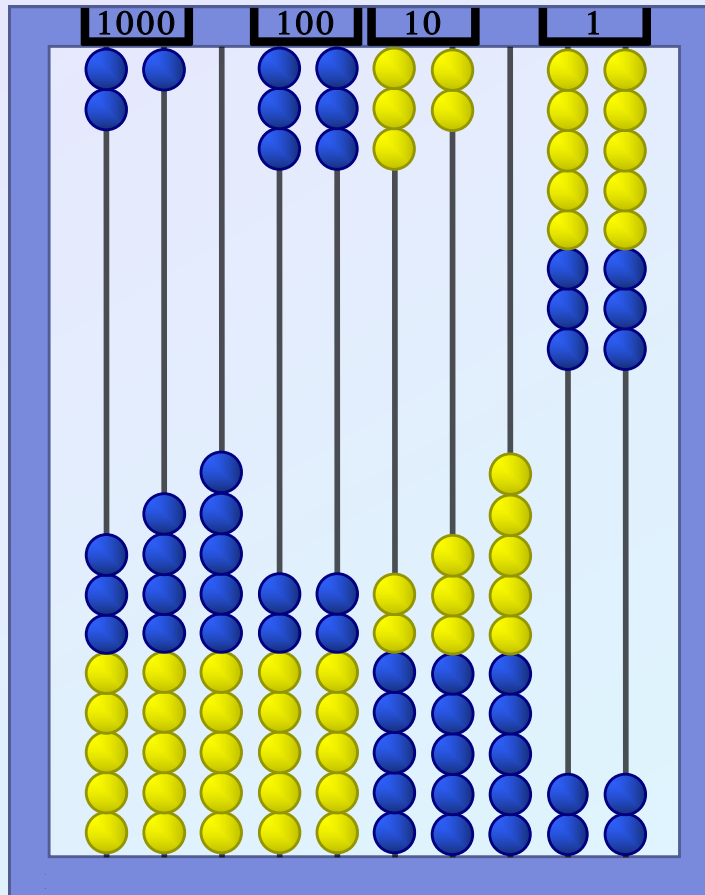
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4

Bead Trading Activity

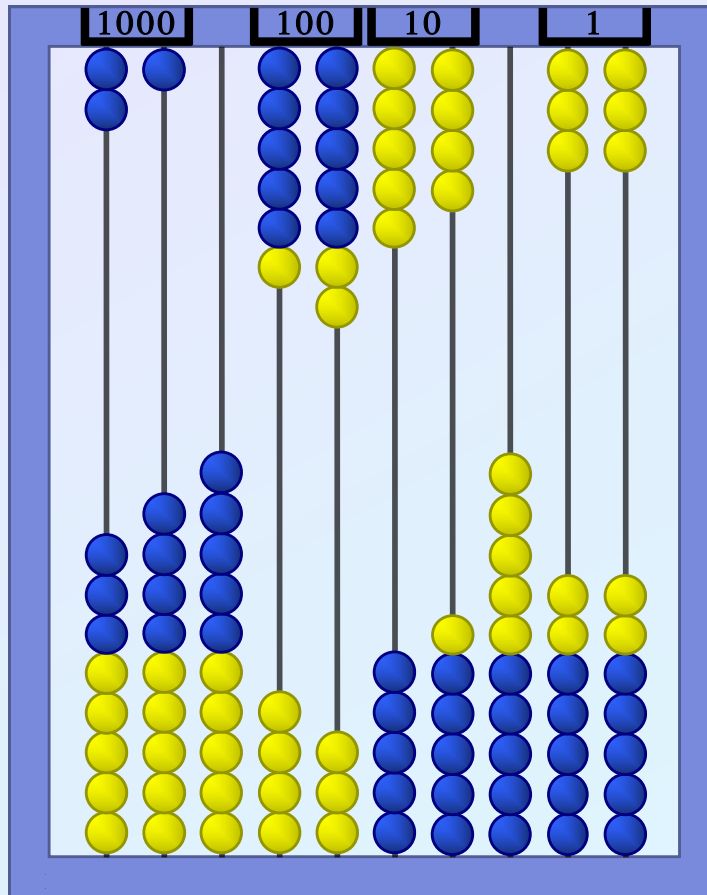


Adding 4-Digit Numbers



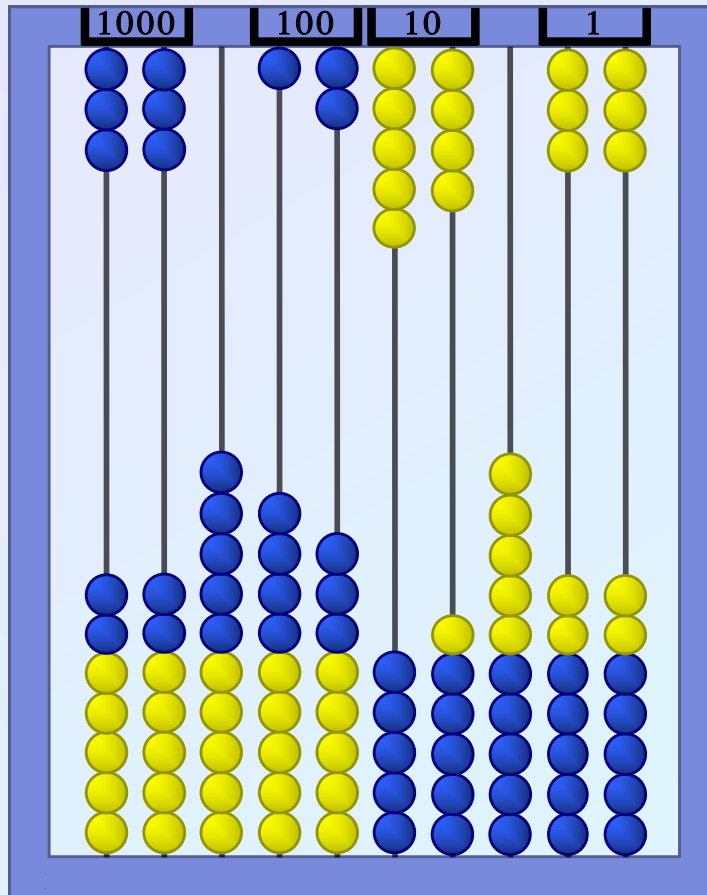
$$\begin{array}{r} 3658 \\ + 2738 \\ \hline \end{array}$$

Adding 4-Digit Numbers



$$\begin{array}{r} 1 \\ 3658 \\ + 2738 \\ \hline 6416 \end{array}$$

Adding 4-Digit Numbers



$$\begin{array}{r} 1 \quad 1 \\ 3658 \\ + 2738 \\ \hline 6396 \end{array}$$

In Summary

- Introduce quantities and operations in a visualizable manner.
- Use transparent number naming.
- Introduce written numerals using place-value cards.
- Play games to reinforce concepts and bring joy.

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