

# Standard Place Value vs Deep Understanding:

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## Background:

Place value is one of the Big Ideas in number identified by Dr Dianne Siemon during the National Middle Years project as pivotal for later mathematical development.

Students who are missing place value concepts in middle primary school are in danger of failing high school mathematics.

When teaching place value, most teachers focus on routine knowledge and skills. For example:

- Writing in digits and in words
- Writing in expanded notation or in hundreds, tens and ones
- Simple regrouping
- Ordering numbers (relative position rather than relative size)
- Positioning numbers on pre-set number lines (e.g. a number line to 1000, broken into hundreds)

Deep understanding of PV is very different to routine content. Many students can write numbers in words, in expanded notation, and order them, but do not understand how close 100 is to 1000. Deep understanding of PV leads to far more flexible mathematical structures.

In this workshop we will focus on developing deep understanding and transference of concepts through:

- Relative size of small numbers – how big is 7 compared to 10?
- Relative size in base 10 systems – how big is 100 compared to 1000? How big is 1 million?
- What changes a number and what doesn't change it? Regrouping and renaming numbers with non-standard partitions
- Decimal points as an indication of relative size rather than relative position

## Decimal numbers:

### Standard questions:

Write the following number in words

Order these numbers

How many ones/tenths/hundredths in this number?

Match the representations in words, as common fractions, as decimal numbers and colour in the number of parts from the square representing one whole

### Non-standard questions:

Make 23.7 straws/MAB blocks – if I move the straws or blocks around, is it still 23.7?

Which of these representations is the same? (Using non-standard partitions)

If  $1/10$  is 0.1 then how come  $2/5$  isn't 0.25 or 2.5?

Place these numbers on a number line between 10 and -10 (note: lots of kids confuse decimal numbers and negative numbers): 0.5, 0.7, 0.34, 0.2, 6.3,  $74/10$

## Standard Place Value vs Deep Understanding:

### Naming and regrouping

#### Standard question:

How many hundreds are there in 1324?

Write 1324 in expanded notation

How many tenths are there in 3.45?

#### Non-standard question:

Which of the following is equal to 1324?

- $100 + 300 + 20 + 4$
- 13 hundreds + 1 ten + 14 ones
- 11 hundreds + 22 tens + 4 ones

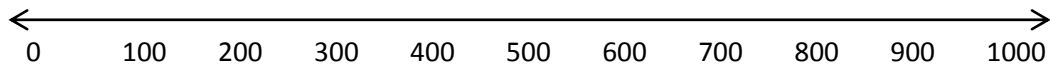
Which of the following is the same as 3.45?

- $3 + 45/100$
- $3 + 1/10 + 35/100$
- $3 + 4/10 + 5/10$
- $2 + 14/10 + 5/100$

### Ordering, comparing and size

#### Standard questions:

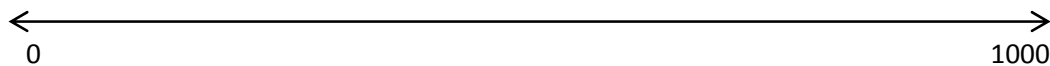
Place the following numbers in ascending/descending order, then place them on the number line below: 650, 750, 250, 850



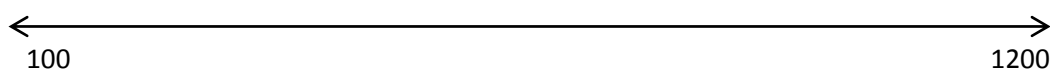
Which number is the largest? Which is the smallest?

#### Non-standard question:

Place the following numbers on the number line below: 10, 100



Place the following numbers on the number line below: 650, 750, 250, 850



What would it look like to build a 1 million MAB block? How big would it be?

# Standard Place Value vs Deep Understanding:

## Tens and Ones:

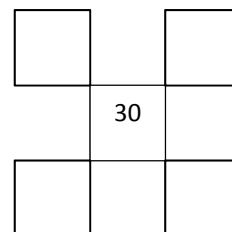
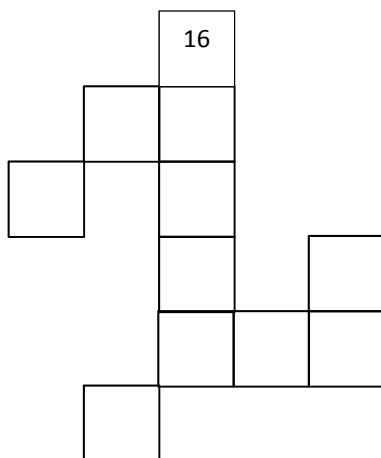
### Standard question:

What are the patterns in a hundreds chart? Colour the counting patterns for 2s, 5, and 10s.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

### Non-standard question:

The following squares are parts of a hundreds chart. Fill in the missing numbers. What are the patterns?



Cut up the hundreds chart into pieces and complete the jigsaw puzzle.