<u>Place Value</u>

"...the understanding of number patterns and the logic to the naming systems and values of number" (Department for Education, Numeracy School Improvement)

Micro Content

Order of digits makes a difference

Additive property – The quantity represented by the whole numeral is the sum of the values represented by the individual digits

Positional property – The quantities represented by the individual digits are determined by the position they hold within the whole numeral

Base 10 property – The value of columns or positions increases by a power of 10 moving right to left and decreases by a power of 10 moving from left to right

Multiplicative property – The value of a number is determined by the products of its face and place values

There are patterns in the way we read and say numbers

There are patterns in the way we write numbers

Patterns in the number system can help us build other numbers

Place value columns have names

Zero can hold a place

A 10 group is seen as a special entity which can be counted

The term 10 group can be applies to 'ten tens' or 'ten hundreds' and so on

We can skip count by ten, hundred etc. both forwards and backwards in place value parts

Numbers can be partitioned in flexible ways using standard and non-standard partitions

Number partitioning can be shown as indicative of digit value and place value. For example, 26=20 + 6 or (2x10) + (6x1)

Common misconceptions:

Students who are able to recite the number naming and students who are able to identify placevalue parts (e.g. they can say that there are 4 hundreds 6 tens and 8 ones in 468) and count orally to 100 and beyond understand place value.

Diagnostic testing exposes many of these students still think about or imagine 2- and/or 3-digit collections additively in terms of ones (i.e. 468 is actually understood as the sum of 400 ones, 60 ones and 8 ones).

This could be due to/associated with:

■ inadequate part-part-whole knowledge for the numbers 0 to 10 and/or an inability to trust the count (see Trusting the count tools39)

■ an inability to recognise 2, 5 and 10 as composite or countable units (often indicated by an inability to count large collections efficiently)

■ little or no sense of numbers beyond 10 (eg fourteen is 10 and 4 more); and/or

■ a failure to recognise the structural basis for recording 2-digit numbers (eg sees and reads 64 as 'sixty-four', but thinks of this as 60 and 4 without recognising the significance of the 6 as a count of tens, even though they may be able to say how many tens in the tens place).

Students need a deep understanding of the place-value pattern (10 of these is 1 of those), to support more efficient ways of working with 2 digit numbers and beyond. Place value is difficult to teach and learn as it is often masked by successful performance on superficial tasks such as counting by ones ona 0-99 or 1-100 chart.

The structure of the base 10 number system is essentially multiplicative, as it involves counts of different sized groups that are powers of 10. Unfortunately, place value is often introduced before students have demonstrated an understanding that the numbers 2-10 can be used as countable units and/or before any formal work with equal groups.

As a consequence, many students develop misconceptions in this area which serve to undermine their capacity to use place value based strategies to support efficient mental and written computation and their later understanding of larger whole numbers and decimal fractions.

Dianne Siemon, RMIT University: June 2006.