Developing Basic Multiplication Skills for Understanding

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Following on from my brief article in LTM 15 (December 2013) regarding mental mathematics, the purpose of this article is to suggest a variety of strategies or ideas for developing multiplicative reasoning and understanding.

PATTERN MAKING

Pattern making can be a powerful method to employ when teaching multiplication, particularly if you want to strengthen learners' familiarity with a particular multiplication table or if your learners do not yet know their multiplication tables. Begin by drawing up a simple table for a particular multiple. The idea is for learners to then use the skills they already have to develop the multiplication table. As an example, consider the multiples of 8. Begin by tabulating $1\times 8=8$. All learners should hopefully know this. Now make use of doubling, which is a strategy that learners should have developed from the mental mathematics you have previously done with them. So, 1 doubled is 2 and 8 doubled is 16. We can now tabulate $2\times 8=16$. Continuing this doubling process: 2 doubled is 4 and 16 doubled is 32, which gives us $4\times 8=32$. We can now carry on with our doubling to get $8\times 8=64$, or we can go back and fill in some of the missing multiples. To get to $3\times 8=24$ we can work from the previous multiples $1\times 8=8$ and $2\times 8=16$ by adding 1 and 2 to get 3, and adding 8 and 16 to get 24. To get $5\times 8=40$ we could either work with $1\times 8=8$ and $4\times 8=32$ by adding 1 and 4 to get 5, and adding 8 and 32 to get 40, or we could use a similar technique with $2\times 8=16$ and $3\times 8=24$, adding 2 and 3 to get 5, and adding 8 and 32 to get 40. By using this technique learners are not only developing and simultaneously learning their multiplication tables, but they are also applying and reinforcing what they have previously learnt. As an extension one can then use the same technique with bigger numbers, e.g. $10\times 8=80$, $20\times 8=160$ etc., or even bigger numbers like $100\times 8=800$, $200\times 8=1600$ etc.

$1\times 8 = 8$
$2\times 8 = 16$
$4\times 8 = 32$

COUNTING THE MULTIPLES

Most teachers do "counting" in the classroom, but it is often the way in which it is done that will influence whether your learners are counting with or without understanding. Far too often learners are simply going through the counting ritual without any real understanding. One way to help learners engage more meaningfully while counting is to write the multiplication tables on the board so that learners can both see and hear them at the same time.

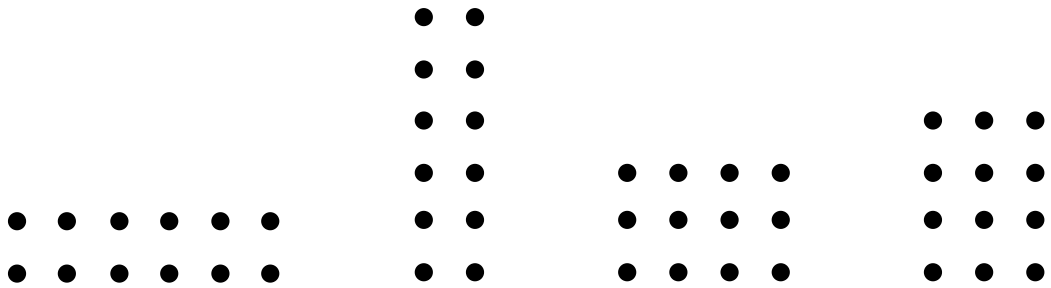
PARTITIONING THE MULTIPLICAND OR THE MULTIPLIER

Partitioning, which is similar to decomposing numbers, is essential to developing fluency and accuracy with numbers. It builds a foundation for understanding the place value system which requires flexible thinking. If learners are unable to work out 7×9 for example, they should nonetheless be able to partition either the multiplicand or the multiplier into manageable numbers. In my experience I have found that it is best to choose one or the other and then stick to it. By way of example, the number 7 can be partitioned into easier numbers to work with in a variety of ways. Depending on each learner's level of understanding one could use the partitioning of 4 and 3, or alternatively 2 and 5, or even 3, 3 and 1. Partitioning 7 into 1, 2 and 4 we can work out 7×9 with smaller sub-calculations. Since $7=1+2+4$, 7×9 can now be thought of as $1\times9+2\times9+4\times9$. Making use of a doubling strategy we thus have $9+18+36=63$.

The same approach can be used when multiplying two-digit or three-digit numbers. For example, most learners know that $10\times9=90$, so if they are asked to calculate 28×9 the number 28 can be decomposed into $20+8$ and the calculation can be done in smaller steps: $20\times9=180$, $8\times9=72$, and finally $180+72=252$.

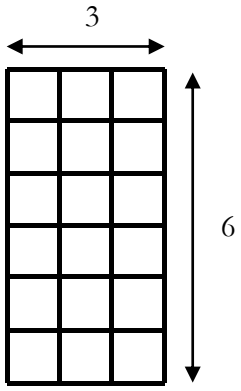
VISUALISING THE MULTIPLES

Especially in the Foundation Phase, using visualization with some form of representation such as beans or counters can be very powerful since the individual items can be physically rearranged. Thus, 12 counters can be arranged in 6 groups of 2, 2 groups of 6, 4 groups of 3 or 3 groups of 4, thereby showing the equivalence of 6×2, 2×6, 4×3 and 3×4.



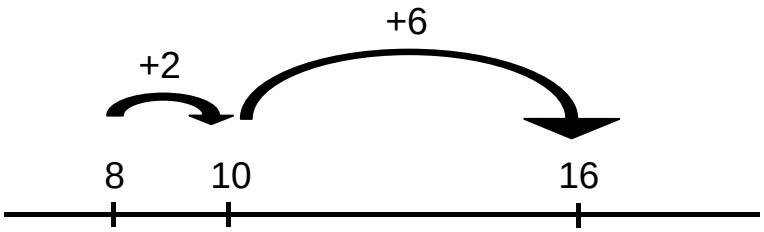
USING AN ARRAY

An easy way for learners to understand multiplication is to make use of an array. Although not the most efficient approach, it still has value in establishing a conceptual foundation for multiplication, and can later link to area calculations. Let us take 3×6 as an example. In order to calculate 3×6, simply draw a 3 by 6 array. Learners can then count in either 3s or 6s, depending on which approach they find the easiest.



THE EMPTY NUMBER LINE

To support learners' thinking – especially for addition, subtraction and multiplication – the empty number line is ideal because the numbers can be drawn on it. This is especially useful for learners who think visually as it provides an accurate yet swift calculation method. For example, when counting in 8s the empty number line can support the learner's thought process by adding on 2 to 8 to get to 10 and then adding on the remaining 6 to get to 16.



Another example would be counting in 9s where the learner could add on 10 to get to 19 and then subtract 1 to get to 18. So the thought process would be $9+10-1$ is 18, $18+10-1$ is 27, etc.

THE 100 OR 200 NUMBER GRID

The 100 grid is another useful resource for developing multiplication skills and recognising patterns. For example, use the 100 grid to count in 2s and ask your learners what they notice. What do all the numbers end in? Now start at 1 and skip-count in 2s. What do all numbers end in now? The 100 and 200 number grids offer a rich source of patterns that can support multiplicative reasoning.

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

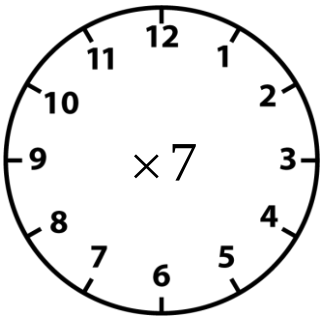
MULTIPLICATION GRID

X	1	2	3	4	5	6	7	8
1								8
2				8				
3								
4		8						
5								
6								
7								
8	8							

When learners complete multiplication grids not only are they practising their multiplication skills but they are simultaneously finding the factors of numbers. For example, the factors of 8 are 1, 2, 4 and 8 and the grid shows that 1×8, 2×4, 4×2 and 8×1 all give an answer of 8. Another activity could be to choose two consecutive numbers, multiply each number by itself, and then determine the difference of the two products. What do you notice?

CLOCK FACE

This activity can be used to consolidate and practice learners' multiplication skills. Learners can work either individually or in groups. Draw the face of a clock on the chalkboard and at its centre write down the operation to be performed, e.g. $\times7$. The teacher then points to different numbers around the clock face and learners multiply each of these numbers by 7. Alternatively, cut out a large circle from cardboard and attach some cardboard hands so that they can be suitably rotated. Point the two hands to two of the numbers around the clock. Learners then need to multiply these two numbers together. The hands can then be moved to create a new question. This activity is a good way of assessing learners' basic skills. A similar process can also be used for addition and subtraction.



MULTIPLICATION TABLES "BINGO"

This is a useful consolidation activity. Make two sets of cards, one set with different multiplication questions and the other set with the answers. Distribute the cards to the learners in your class. The learners with the questions take turns calling out their question and the learner with the matching answer card needs to shout "bingo" and give the answer on the card as confirmation. When all the cards have been matched the cards can be shuffled and re-distributed for a second game. As a variation, get the learners with the answers to call out the number on their card. The learners with the question cards then need to to shout "bingo" if they have the matching card.

40	2 x 7	14	4 x 9
6 x 3	36	5 x 8	18