

Red Oaks Primary School - Swindon

Research Project

Undertaken by Rachel Brittain – Assistant Head

Aims

1. To improve the general standards in mathematics across the school (particularly KS2) by driving a whole school approach to learning times tables and related division facts.
2. To explore questions which diagnose key areas of difficulty in the development of number sense. This information will be shared with staff for whole school implementation and will aim to help the professional community through the NCETM shared portal.

Why did we do this project?

Red Oaks is a two form entry primary school with a nursery. We currently have 482 children on record. When we opened in 2006, we had children joining from many different schools. We had incomplete records and often previous assessment results were not passed on to us. This meant that a true picture of our children in terms of their prior mathematical achievement was difficult to achieve.

Our SATs and optional SATs results at the end of the first year suggested that mathematics was a much weaker area than literacy and upon analysis of the questions it was apparent that there were some obvious holes in the children's knowledge of number and in particular in multiplication and division.

A full understanding of the number system, the patterns represented by the times tables and their inverse relationship with division, is key to understanding many areas of mathematics including fractions and percentages.

As mathematics co-ordinator I wanted to research and investigate the best possible way to help our pupils learn their times tables. There is much evidence to suggest that learning them just by rote does not ensure that children have an understanding of why these times tables facts are so or how they relate to division.

Research – What does it really mean to know your times tables?

It seems there are many theories on how it is best to teach children their times tables.

Fluency in anything, from a foreign language to times tables, means the ability to have instant recall of facts along with an understanding of what those facts means. Although times tables are often thought of as multiplication tables they also include division tables. Multiplication tables are sets of relationships between three number facts: the table, the multiplier (or factor) and the multiple: a quick way of doing multiple addition. When you can instantly recall the third fact given the other two, without having to stop and think, then you are fluent. This 'instant recall' takes about less than half a second for each fact, so if it takes much longer to find the fact in your head, you may not be fluent.

Pieces of information like 7×8 are not isolated facts. They are parts of the landscape, the territory of numbers, and that person knows them best who sees most clearly how they fit into the landscape and all the other parts of it.

The mathematician knows, among many other things, that $7 \times 8 = 56$ is an illustration of the facts that products of odd and even integers are even, that 7×8 is the same as 14×4 or 28×2 or 56×1 ; that only these pairs of positive integers will give 56 as a product; that 7×8 is $(8 \times 8) - 8$, or $(7 \times 7) + 7$, or $(15 \times 4) - 4$; and so on.

He also knows that $7 \times 8 = 56$ is a way of expressing in symbols a relationship that may take many forms in the world of real objects; thus he knows that a rectangle 8 units long and 7 units wide will have an area of 56 square units.

But the child who has learned to say like a parrot, "Seven times eight is fifty-six" knows nothing of its relation either to the real world or to the world of numbers. He has nothing but blind memory to help him. When memory fails, he is perfectly capable of saying that $7 \times 8 = 23$, or that 7×8 is smaller than 7×5 , or larger than 7×10 , he may say it is something quite different.

And when he remembers 7×8 , he cannot use it. Given a rectangle of 7cm x 8cm; and asked how many 1 sq. cm. pieces he would need to cover it, he will over and over again cover the rectangle with square pieces and laboriously count them up, never seeing any connection between his answer and the multiplication tables that he has memorised.

(From "How Children Fail" by John Holt. page 110)

Learning styles

It is now well known amongst teachers that individuals learn best in many different ways, sometimes using a variety of learning styles. But teachers may not always present information and learning experiences in the ways that best suits the child.

Forms of learning times tables can include learning by rote, practical activities or music. Sometimes, children find it difficult to learn their times tables or feel they are not good at learning when it may be just that the style doesn't suit them.

In the light of the research carried out, I decided to approach this project firstly by carrying out a diagnostic assessment to discover where there are gaps in our pupil's knowledge. Secondly to develop a whole school approach to the teaching of times tables that include a range of learning styles.

A dynamic approach to teaching times tables – What did we do?

<i>What we did</i>	<i>How did we use this?</i>
<p>Step 1: After carrying out research (see above), we realised that in order for us to have an understanding of where our children were in terms of their understanding of the number system and times tables, we would have to carry out some initial diagnostic assessments. For this we used 'Diagnostic Interviews in number sense by Hazel Denvir and Tamara Bibby'.</p>	<ul style="list-style-type: none"> • This was used with children performing 3 or more sub-levels below the average for their year group. Tests were carried out on children from years 3-6. This is time consuming and took several days of TA and maths co-ordinator time. • The results were used to identify gaps in children's knowledge that was hindering their understanding of number patterns and sequencing, the number system and times tables. • The key findings from these tests were fed back to teachers in bullet points which were then fed into IEPs. These were also shared with parents so that they are aware of targets to work on at home. <p>Other useful books for research that were used by Red Oaks were: BEAM – Times files by Mike Askew (£12.50) and BEAM – Times Tables Tactics by Peter Critchley (£19.50)</p>
<p>Step 2: Staff meeting and training. A staff training session was held where the theories and research about learning times tables was shared. We discussed how else we could help our children learn and decided the following:</p> <ul style="list-style-type: none"> • A list of useful websites for learning times tables through games was to be collected with contributions from all year groups • A times table weekly race was agreed from years 2-6. Scores to be kept to prove how this is helping to develop speed and accuracy. • Times table games for the classroom and for at home were shared. 	<p>Link to a list of web sites for fun ways to learn times tables and also to times table race and answers levels 1, 2 and 3</p> <p>http://www.redoaks.org/for_children01.php</p>
<p>Step 3: A times table song was written and recorded by each class from years 2-6.</p>	<p>Link to school website to hear times table songs written by the children.</p> <p>http://www.redoaks.org/for_children01.php</p>
<p>Step 4: Parent workshop – teaching times tables at home.</p>	<p>Link to booklet produced by the school 'Teaching Times tables' and link to 'Times Table ideas for at home' (Appendix 1)</p> <p>http://www.redoaks.org/for_children01.php</p>

<p><u>Step 5:</u> Analyse results from mathematics audit. This is carried out in our school three times a year. The same 3 questions are asked on each of the 4 numerical operations (questions set appropriate to year group). The scores are analysed and acted upon.</p>	<p>Results are shared in meetings and any recommendations are made. Maths audit, answers and record sheet. See Appendix 2</p>
---	---

Reflections and Outcomes –What did pupils and teachers gain from this experience?

- Clearly defined IEP targets that inform teaching;
- Resources to use on the school website www.redoaks.org;
- A mathematics audit that will be used across the school 3 times a year. Results from all classes show an improvement in all areas of calculations
- Results from the time table race in all classes show a marked improvement in scores.

Quotes from pupils

‘Using the times tables race and a timed grid to fill in has helped me a lot. In maths I know that division is related to times tables – you can’t do one without the other.’ Sophie Y5

‘I practise a lot and in numeracy we do loads of work and I can see patterns and I understand how it all works.’ Josh Y4

‘I have practised in all sorts of ways. The song we recorded helped me to remember my times tables.’ Joel Y2

‘Games have helped me to learn and every time I do my times table race I want to get better.’ Laina Y2

‘When I have done my times table race I think I’m getting better. Regular practise in school has helped me.’ Aston Y6

‘Learning at school has made me motivated to do more at home so that I can improve my scores each time. I can see lots of patterns now and I can use them to help me with division. I used to find division difficult but now I use my times tables to help me.’ Jordan Y6

‘In year 5 my confidence has got better since we have been doing more on times tables at school.’ Luke Y5

Quotes from staff

'My class have got so much out of the times tables songs. We have danced and sang every week and the children beg me to put them on again! This has been a key part of our numeracy this year' Mr Smart Y3

'The times table race has really helped my children to become enthusiastic about learning times tables as they really strive to better their score each week' Miss Webster Y5

I think that even if children struggle at the start, they soon improve bit by bit. The website games and times table race are very motivational.'
Mrs Major Y3

'I can't believe my children have done so well this year. Even if in some cases it's small steps, they all know more and confidence is much better.'
Mrs Johnson Year 2

'The targets that were set as an outcome from the diagnostic assessment clearly identified gaps for future teaching. I have also found that the children have used the practise on the website to improve their own scores.' Mrs Capstick Year 6

Regional Coordinator's Note:

If you are interested in running your own project on an issue of your choice please get in touch with me (pete.griffin@ncetm.org.uk) and I will do all I can to support you and help you get going. There may even be some funding I might be able to help you get to support your work.

Appendix 1

Times table ideas for at home

- Times table race – see Red Oaks website insert url here: Homework, maths, quick number, times table race.
- Times table BINGO! Write 9 numbers from a chosen times table in a 3 x 3 (or bigger) grid. Parent to say the times table and children to tick the correct answer until someone shouts BINGO! Tip: record the questions you have asked so you can check the winners' answers.
- Make up songs/raps with each times table – you could record or video these!
- Sing your times tables – there are plenty of great CDs available.
- Times Tables: Learn the Tables with Songs and Games by CRS Records
- Learn Your Times Tables Kit: Five Ways to Learn with Sticker and Other and Workbook and CD (Audio) and Charts and Magnet(s) by Carol Vorderman
- Musical Times Tables by Don Spencer
- Ragged Bear's Times Table CD: 0 by Ragged Bears Publishing Ltd

Appendix 2

Calculation Audit Sheets

(Years 3 to 6)

Name _____

Class _____

Date _____

Calculations Audit - Year 3

$36 + 58$	<input data-bbox="1125 667 1484 761" type="text"/>
$16 + 5 + 3 + 7$	<input data-bbox="1133 1097 1492 1191" type="text"/>
$115 + 432$	<input data-bbox="1133 1541 1492 1635" type="text"/>
$41 - 35$	<input data-bbox="1133 2004 1492 2098" type="text"/>

178 - 56	
783 - 356	
9 x 3	
8 x 5	

6×20	<input data-bbox="1131 472 1497 566" type="text"/>
$26 \text{ divided by } 2$	<input data-bbox="1131 947 1497 1041" type="text"/>
$75 \text{ divided by } 5$	<input data-bbox="1131 1404 1497 1498" type="text"/>
$65 \text{ divided by } 10$	<input data-bbox="1131 1874 1497 1968" type="text"/>


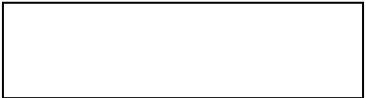


Name _____

Class _____

Date _____

Calculations Audit - Year 4

$295 + 86$	<div data-bbox="1134 669 1497 763" style="border: 1px solid black; width: 100%; height: 100%;"></div>
$£4.21 + £3.87$	<div data-bbox="1134 1099 1497 1193" style="border: 1px solid black; width: 100%; height: 100%;"></div>
$219 + 193 + 74$	<div data-bbox="1134 1543 1497 1637" style="border: 1px solid black; width: 100%; height: 100%;"></div>
$27 - 19$	<div data-bbox="1134 1957 1497 2051" style="border: 1px solid black; width: 100%; height: 100%;"></div>

136 - 78	
1258 - 576	
16 x 2	
5 x 35	

36 x 18	<input data-bbox="1107 472 1471 566" type="text"/>
36 divided by 4	<input data-bbox="1107 927 1471 1021" type="text"/>
320 divided by 4	<input data-bbox="1107 1406 1471 1500" type="text"/>
1456 divided by 4	<input data-bbox="1107 1886 1471 1980" type="text"/>

Name _____

Class _____

Date _____

Calculations Audit - Year 5

$587 + 475$	<input data-bbox="1107 669 1471 766" type="text"/>
$£6.72 + £8.56$	<input data-bbox="1107 1099 1471 1196" type="text"/>
$3587 + 675$	<input data-bbox="1107 1543 1471 1639" type="text"/>
$644 - 93$	<input data-bbox="1107 1957 1471 2054" type="text"/>

754 - 86	<input data-bbox="1109 470 1473 566" type="text"/>
£8.95 - £4.38	<input data-bbox="1109 922 1473 1019" type="text"/>
70 x 6	<input data-bbox="1109 1404 1473 1500" type="text"/>
88 x 4	<input data-bbox="1109 1881 1473 1977" type="text"/>

2.7×8	<input data-bbox="1107 472 1473 566" type="text"/>
$56 \text{ divided by } 7$	<input data-bbox="1107 925 1473 1019" type="text"/>
$172 \text{ divided by } 4$	<input data-bbox="1107 1404 1473 1498" type="text"/>
$163 \text{ divided by } 6$	<input data-bbox="1134 1883 1497 1977" type="text"/>

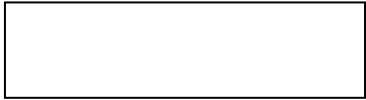
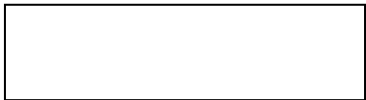
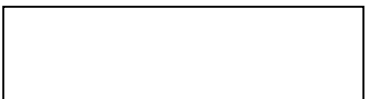
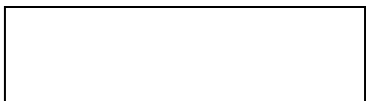
Name _____

Class _____

Date _____

Calculations Audit - Year 6

$7648 + 1486$	<input data-bbox="1107 667 1471 766" type="text"/>
$42 + 6432 + 786 + 3$	<input data-bbox="1110 1099 1476 1198" type="text"/>
$124.9 + 7.25$	<input data-bbox="1107 1532 1471 1630" type="text"/>
$6467 - 2684$	<input data-bbox="1107 1964 1471 2063" type="text"/>

782175 – 4387	
324.9 - 7.25	
125 x 4	
46 x 98	

8×2.3	<input data-bbox="1118 472 1481 566" type="text"/>
112 divided by 7	<input data-bbox="1109 922 1471 1016" type="text"/>
6.3 divided by 7	<input data-bbox="1109 1404 1471 1498" type="text"/>
214 divided by 12	<input data-bbox="1109 1886 1471 1980" type="text"/>

Calculations Audit – Answers Y3-6

<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>	<u>Year 6</u>
94	381	1062	9134
31	£8.08	£15.28	7263
547	4.86	4262	132.15
6	8	551	3783
122	58	668	777788
427	682	£4.57	317.65
27	32	420	500
40	175	352	4508
120	648	21.6	18.4
13	9	8	16
15	80	43	0.9
6 r5 or 6.5	364	27 r1	17 r10