A Whole School Approach to Teaching and Learning TIMES TABLES

Year-Long INNOVATION Project

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Where did this all begin?

‘*Nine-year-olds should recite times tables by heart. Primary schools should adopt Chinese-style teaching methods, with an emphasis on memorising times tables*’

Schools Minister Nick Gibb.

New Multiplications Check Test (MCT) from June 2020

Knee jerk result from schools might be to focus on rote learning without understanding

That **won't help improve attitudes** to maths!

ME!

OH NO …not more TIMED maths tests!

Can I stop this happening? … Unlikely!

Then schools are going to **need some support** here

Not enough children have fluency AND conceptual understanding

Knowing them does ease cognitive overload

Times Tables ARE an important tool

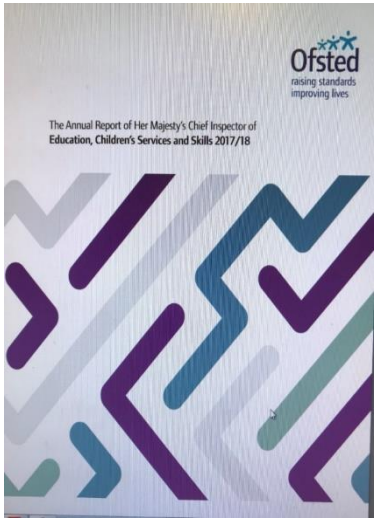
Positive Mental Attitude

Lack of fluency can hold children back from more 'interesting' maths

Schools might not actually teach them in a structured way or with enough understanding

Opportunity to make a positive change!

New Ofsted Inspection Framework (2019): more focus on research based curriculum design



Curriculum knowledge and expertise *(2017 Ofsted Annual Report)*

'A striking conclusion that we have drawn from the findings is that, despite the fact that the curriculum is what is taught, there ***is little debate or reflection about it*** *business of curriculum'*

Taking ownership of our curriculum

I saw this project as an opportunity to give Maths Leads an opportunity to discuss and decide…
shaping their own TTs Curriculum with its own clear rationales

Year-Long Action Research Project

Whole School Approaches to Teaching and Learning Times Tables

8 Whole School Steps to Success
Focus on a Consistent Approach across School

Maths Leads attend 4 half days over the year
Gap Tasks: Practical things to try out in school between training
Professional Log completed for each session
Moodle Direct: A repository for all the materials and a support forum
Qualitative and Quantitative Data Gathered across the Year
Certificate of Attendance

Year one (2017/18) 20 places went in 48 hours
Year two (2018/19) increased 40 places – recruited 50 teachers
(including all schools within an Academy and a Trust)

'Great course, well led, fantastic to meet with other teachers and discuss ideas for development'

Delivery:

- Focus on Deep Understanding and Mastery
- Research Driven
- Focus on conceptual understanding, leading to automation
- Advocates progression and consistency across the school – 'whole school approach'
- Supports schools in taking control of their curriculum

This basically means a focus on …

Principles of Good Practice

Memorization or Automaticity?

'***Memorization*** *of basic facts usually refers to committing the result of operations to memory so that thinking is unnecessary'*

'Teaching facts for ***automaticity*** *in contrast relies on thinking. Answers to facts must be automatic, but thinking about the relationships among the facts is critical.*
A child can then think of 9x6 as (10x6)-6'

Twomey Fosnot, C and Dolk, M (2000:p85)

One of these is more powerful than the other

Recent PISA research for mathematics highlighted that, of all the OECD countries (2019):

- The UK has the highest use of **memorisation, rehearsal, exercises, practices and repetition**
- The UK is lowest in lessons involving elaboration, reasoning, deep learning, critical thinking and non-routine problems.
- UK students are third highest in using 'learning by heart' as a strategy.

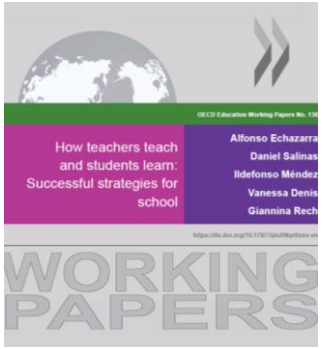
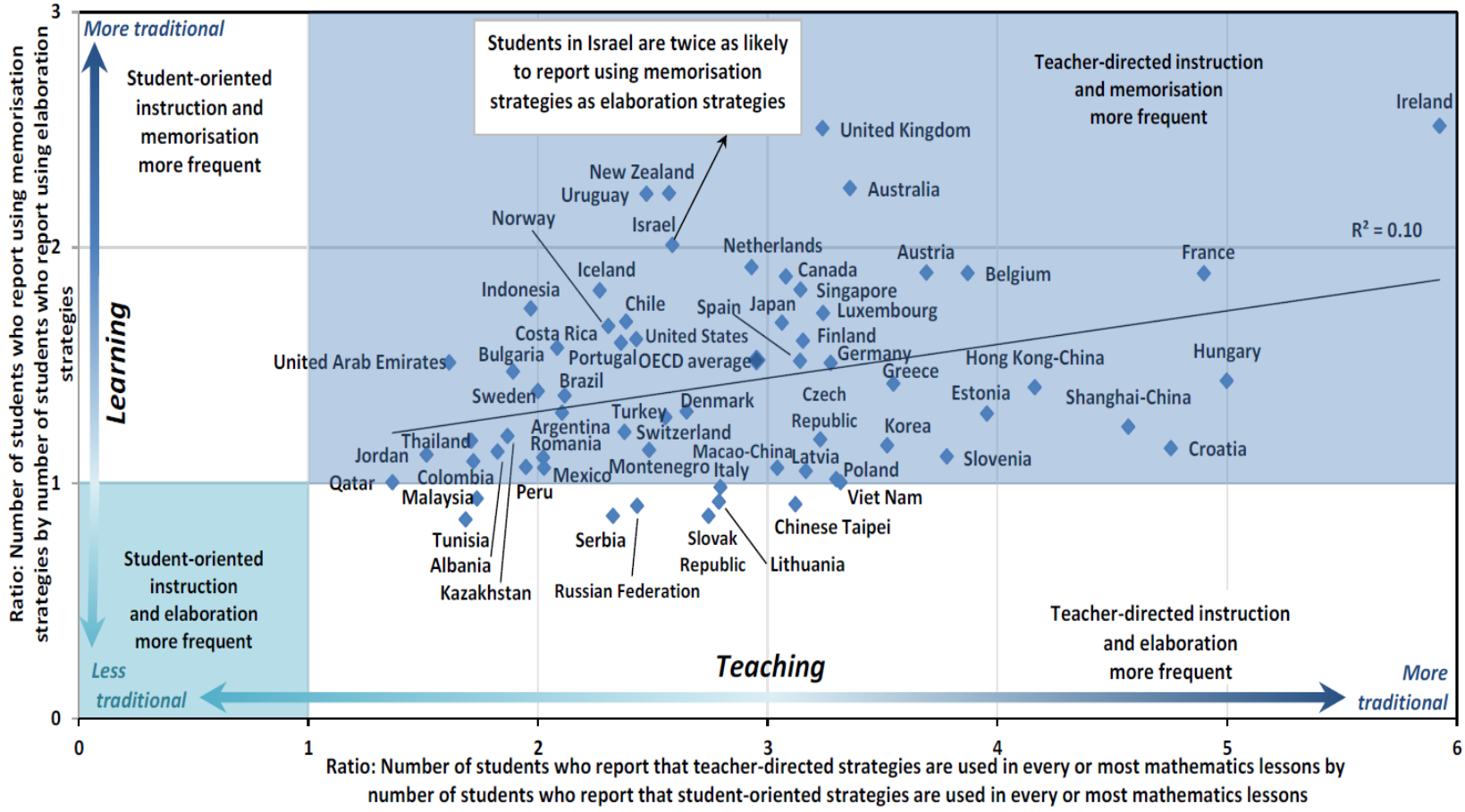
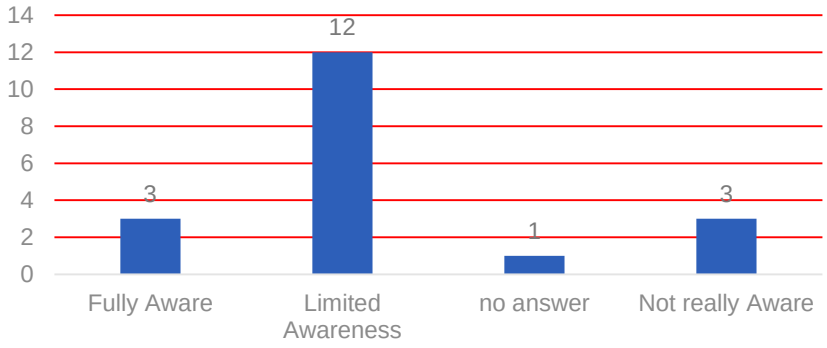


Figure 1.2. Traditional and modern mathematics teaching and learning

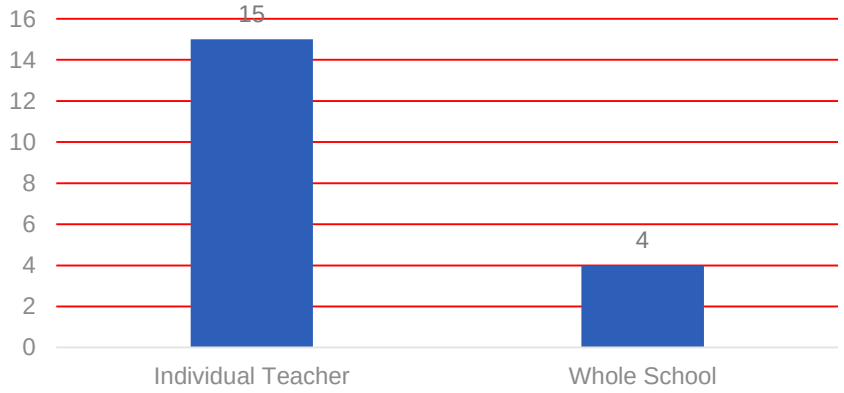


Pre- Programme Questionnaires from Cohort 1

Graph 7 Participants Awareness of Routinely Used Models to teach Times Tables (n)



Graph 8 Local Approach to Teaching Times Tables (n)



86% of Maths Leads were **not really aware** of how TTs were taught in their School

Only 21% of Maths Leads had any whole school approaches to teaching TTs in their School

This was not a surprise to be as Maths Leads are overworked and have been stretched in many directions with too many priorities

A Flavour of Some Steps and Our Approach

WHOLE SCHOOL STEP 1

Decide the **order** in which your school will teach the times tables, **which tables** will be included and **why**

Have you actually planned for this before?

CONSIDER …

When will you teach each one?

How does it build on **intelligent practice**?

Will you include the **1x table?**

How could this support ‘unitizing’

*Julia Anghileri (2009) tells us that ‘Children’s first experiences of multiplication arise when they make groups with **equal** numbers of objects and recognise the possibility of counting the groups rather than counting individual items.’* Unitizing

Understanding equal and not equal

Will your school include **0 times table?**

Will you include the **square table?**

National Curriculum

MULTIPLICATION & DIVISION FACTS					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
count in multiples of twos, fives and tens (copied from Number and Place Value)	*count in steps of 2, 3, and 5 from 0, and in tens from any number, forward or backward* (copied from Number and Place Value)	*count from 0 in multiples of 4, 8, 50 and 100* (copied from Number and Place Value)	*count in multiples of 6, 7, 9, 25 and 1 000* (copied from Number and Place Value)	*count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000* (copied from Number and Place Value)	
	recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers	recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables	recall multiplication and division facts for multiplication tables up to 12 × 12		

How I might plan it …discuss

Focus on **ONE times table each half term (neural pathways)**
…with opportunities built in to also practise those learnt previously

YEAR	First half term	Second half term	Third half term	Fourth half term	Fifth half term	Sixth half term
Year 1	Experience of counting in 1s, 2s, 5, 10s					
Year 2	1x	(1x) 2x	5x	(5x)10x	0x (and revision)	revision
Year 3	(2x) 4x	(4x) 8x	3x	(3x) 6x	(6x) 12x	revision
Year 4	X9	x7	x11	Squares	revision	Test: June from 2020

You may prefer to swap x5 and x10 but links should still be made between them with CONCEPTUAL understanding e.g. use of cubes to show relationships

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

The square times table and commutativity

WHOLE SCHOOL STEP 3

Introduce a new TT by first making clear conceptual links to the real world

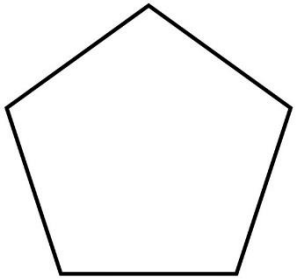
A Classroom Display

what comes in …..?

Walks around school – photos – homework

WHAT COMES IN 5s?

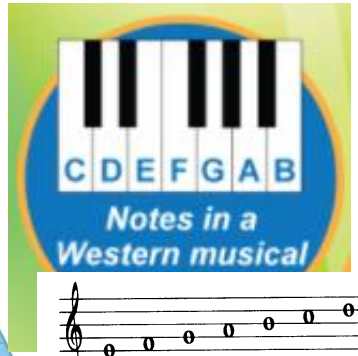
ALWAYS start here – and make a class display of children's ideas

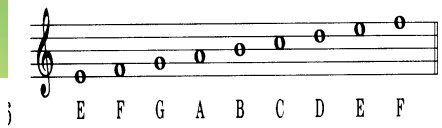


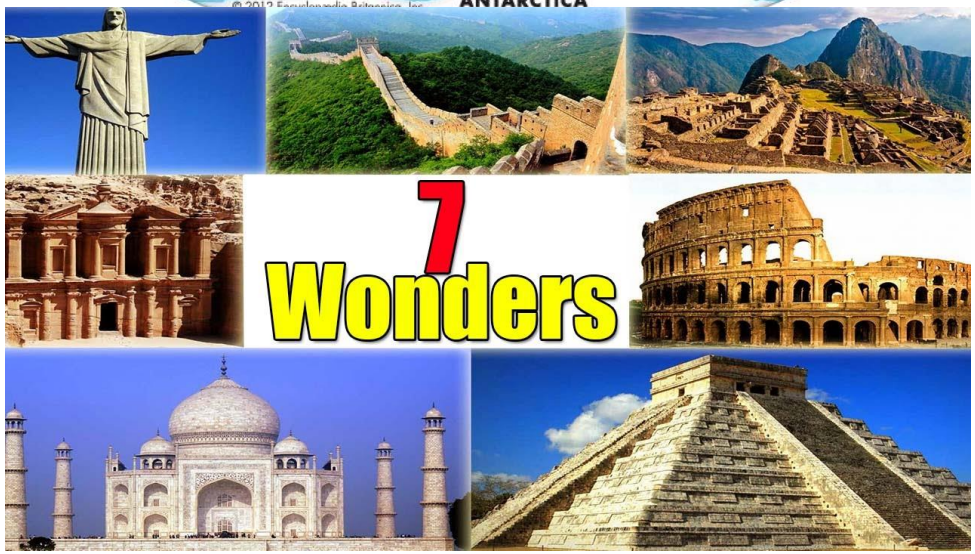
1. Conceptual understanding
2. Great source for word problems
3. Keep adding to it – focus on one table each month

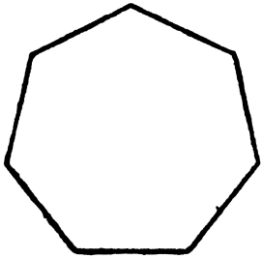
Making clear conceptual links to real world

What comes in 7s?

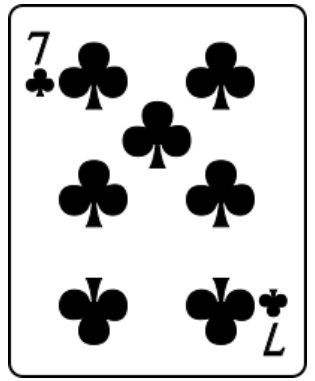








Heptagon



Ideas for their class display from Year 4 Haimo Primary

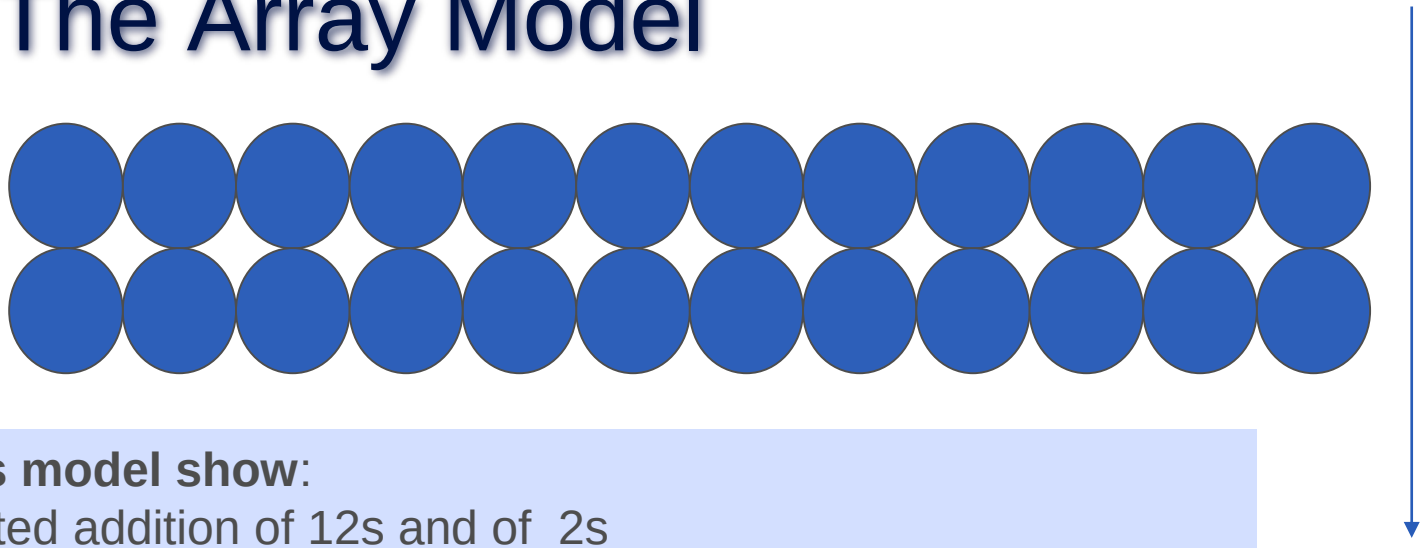
WHOLE SCHOOL STEP 4

Core Representation and the importance of CPA

An investigation into models, properties and laws of multiplication …

which leads to a focus on the power (and limitations) of the Array

The Array Model

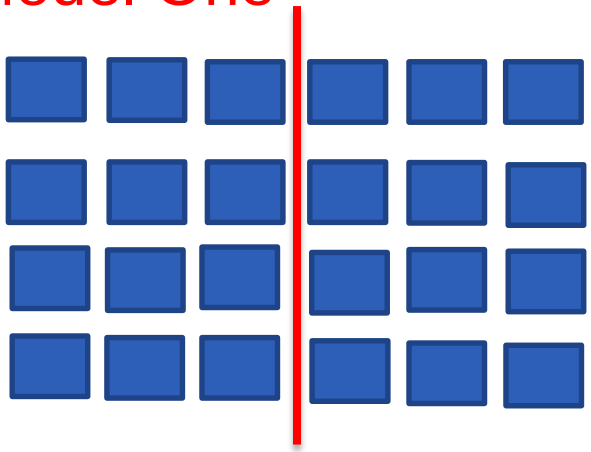


Does this model show:

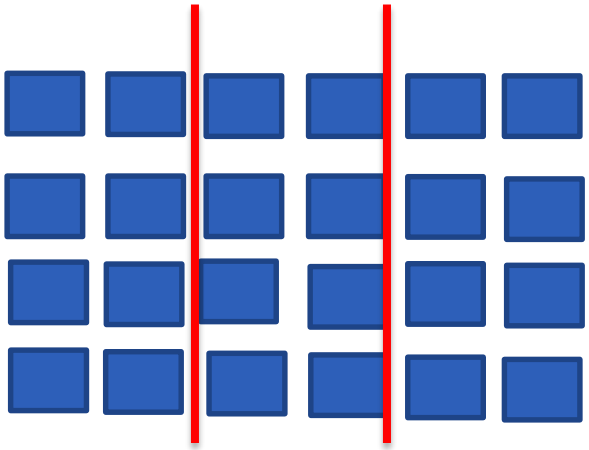
- Repeated addition of 12s and of 2s
- 24÷12=2 and 24÷2=12
- 2x12=24 and 12x2=24
- 10x2 plus 2x2 =24 or any other distribution (by PV and NB)
- Can it show the associative law?

Associativity

Model One

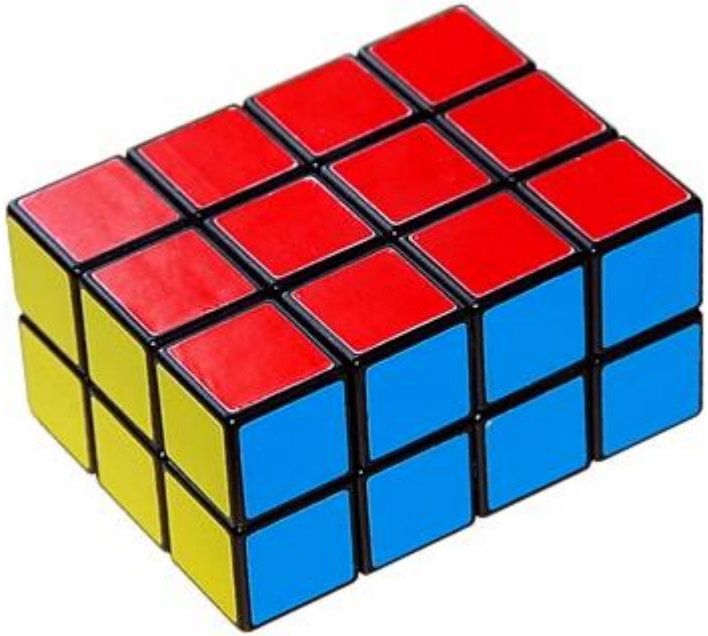


2x(4x3)=24

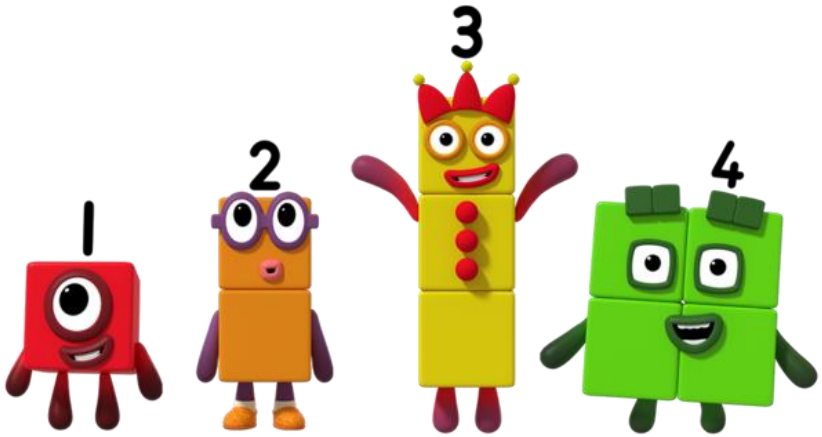


(2x4)x3=24

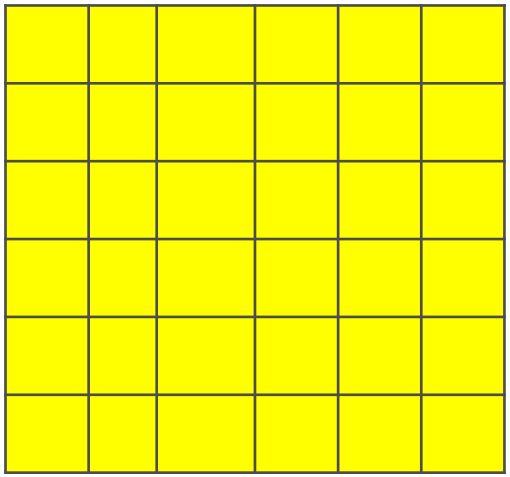
Model Two

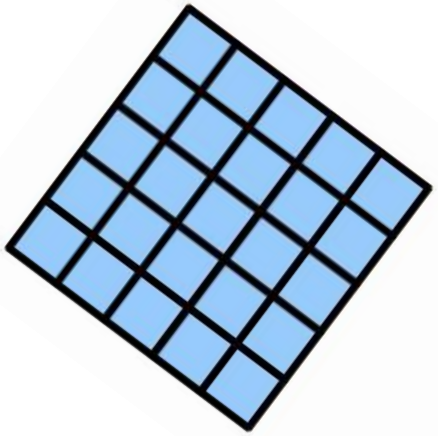


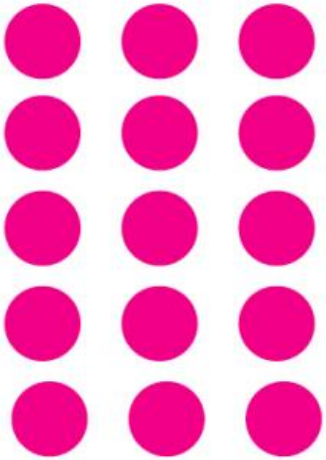
Whole School Progression
What does it look like in EYFS?



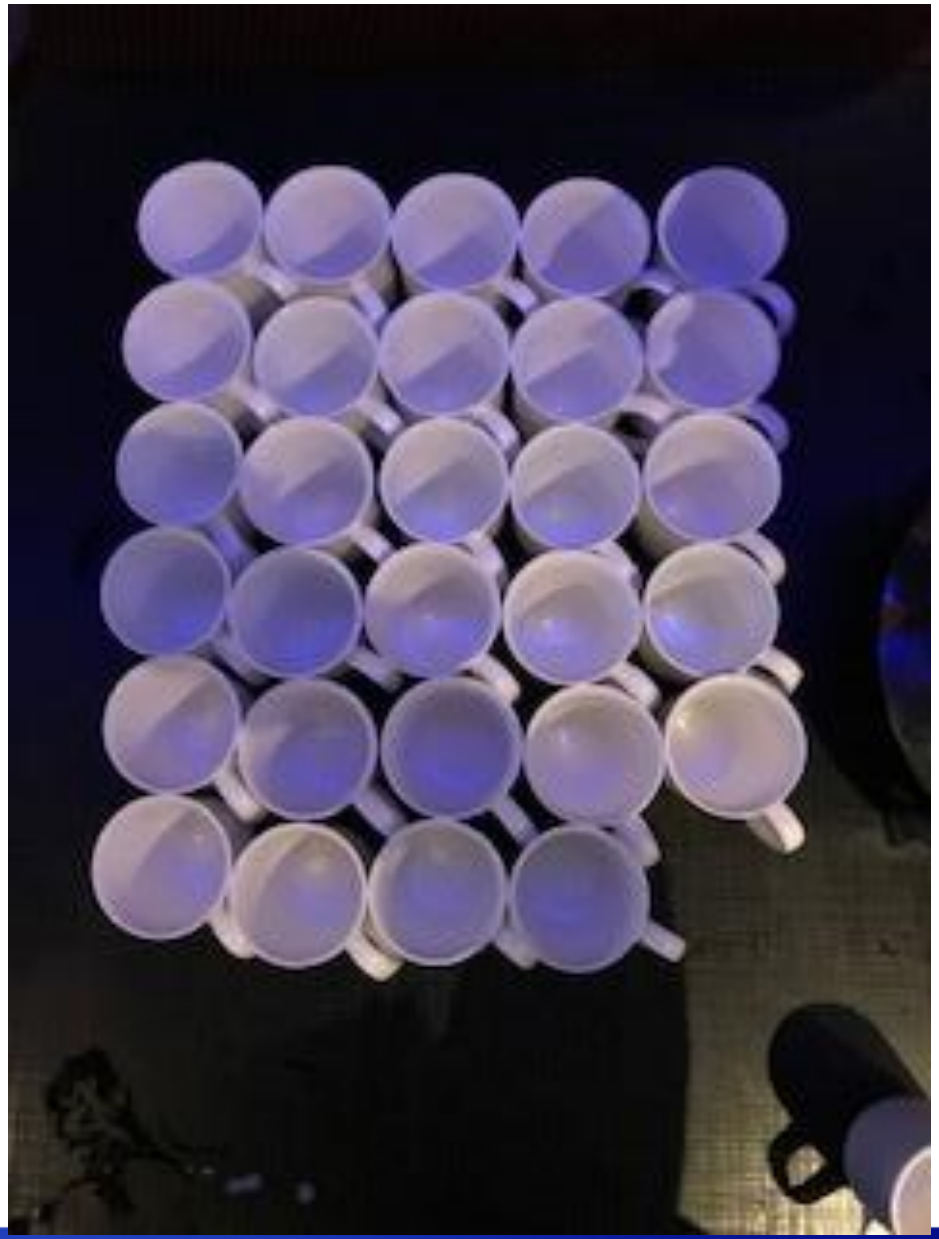
What do you notice?





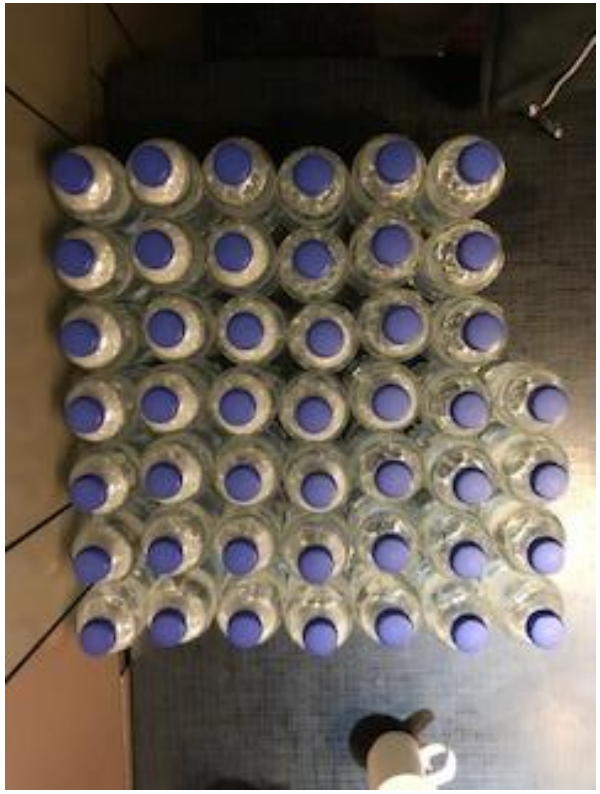


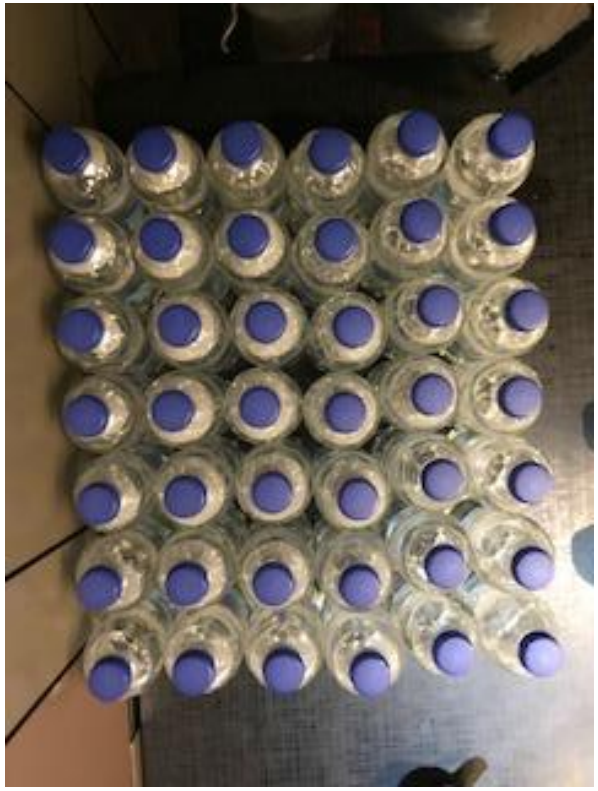
What are the similarities?
What are the differences?



What's the same?

What's different?





What is an array? **What is not an array?**

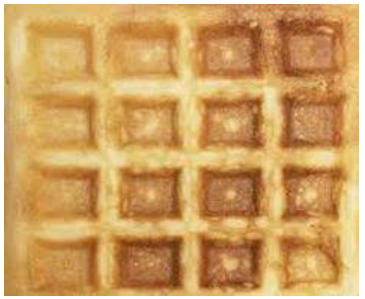
Generalisation? **Stem Sentences?**

Exploration of Commutative, Distributive, Identity, Associative Laws; factor/factor product, square numbers, prime numbers, inverse etc.

How are they used in daily life?

Making Arrays Real

array walks, photos, displays



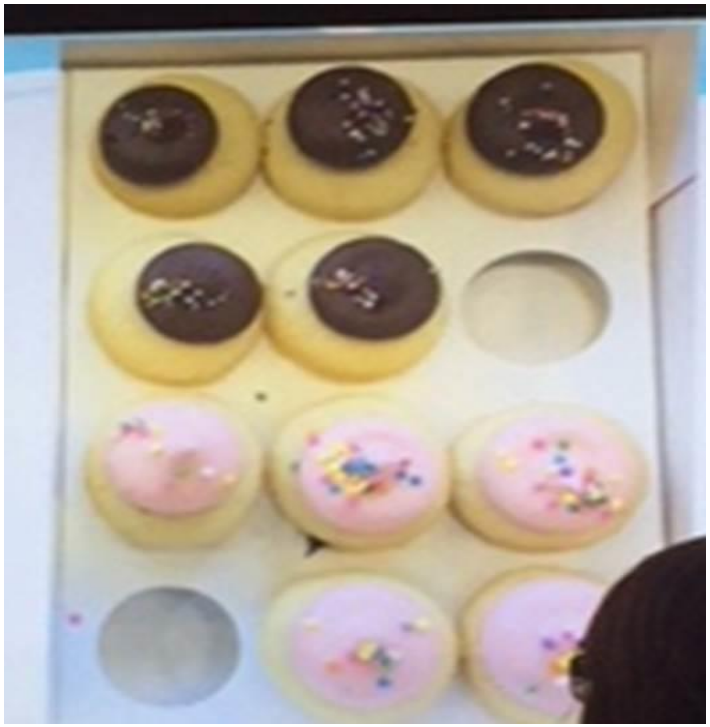


Photo by Karen Wilding

Exploratory Talk

Progressing on, examples include …

Open arrays and links to Area/Perimeter
Long Multiplication and Grid Method
Multiplication of fractions etc..

Evaluations

'Just wanted to say I really enjoyed the session and have started to play some of the games you showed us in this session'

'Your passion and enthusiasm for maths education and the development of practise is contagious and admirable'

' The session and resources you have demo are brilliant Looking forward to the next instalment -'

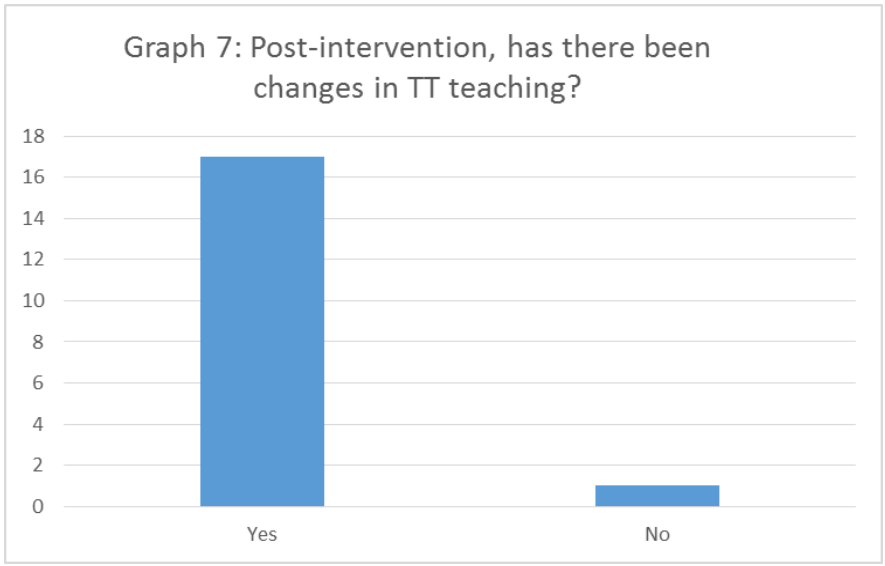
'I found the sessions attended so insightful

'Thank you so much for your entertaining and engaging first session at the times tables project yesterday!'

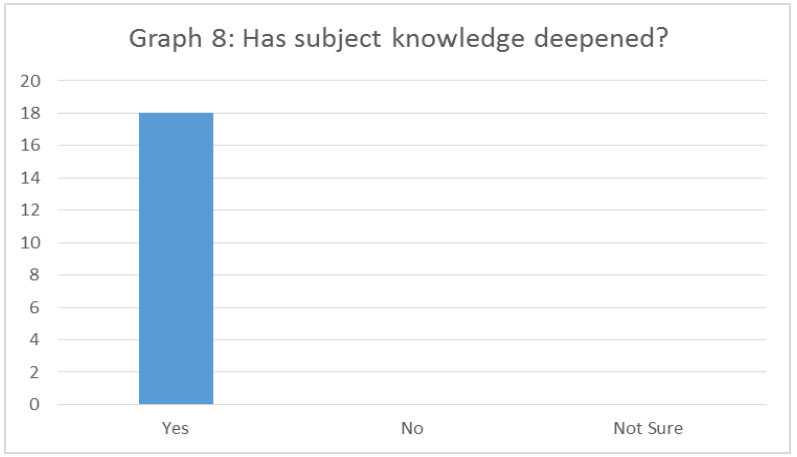
'I've already done staff meetings and modelled some of your activities'

'Thoroughly informative- great practical ideas and theory'

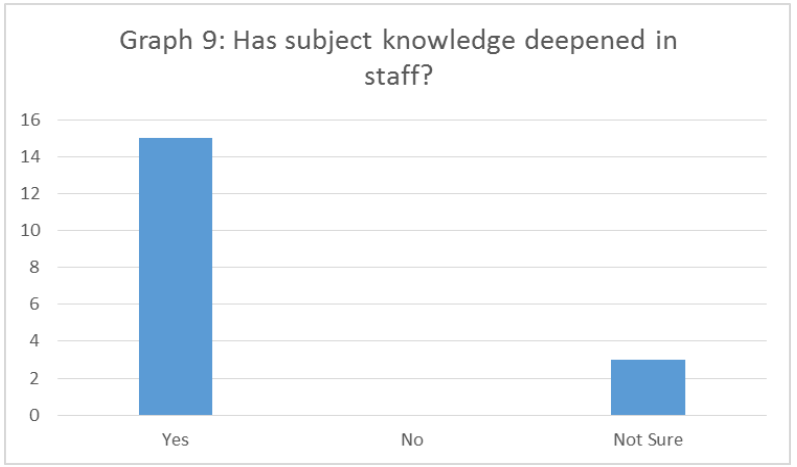
Early Impact



'*no*' response: free text *'intend to start next academic year'*

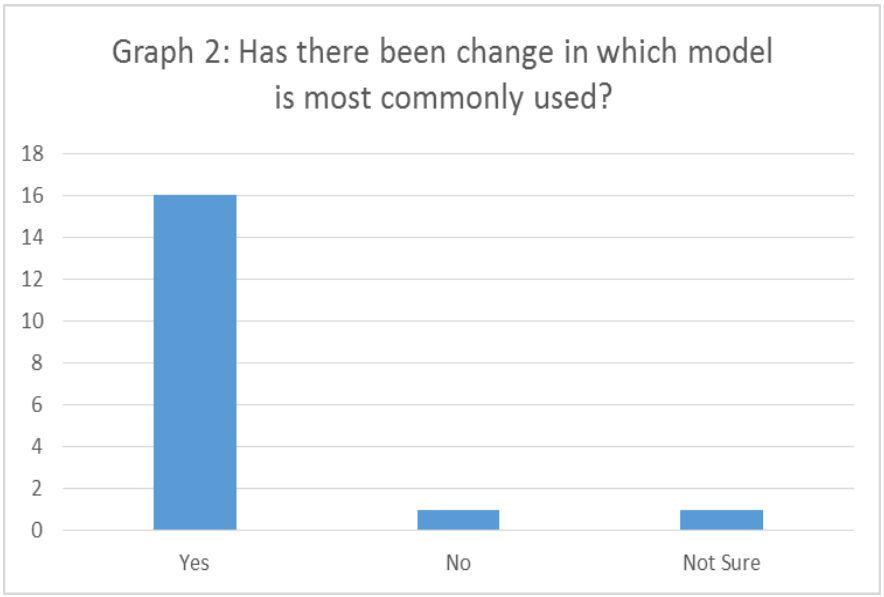


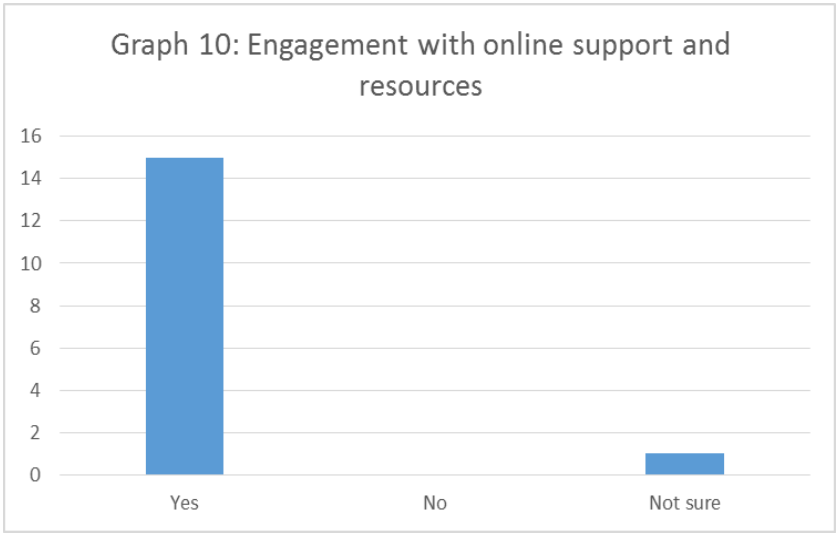
Maths Lead Subject Knowledge

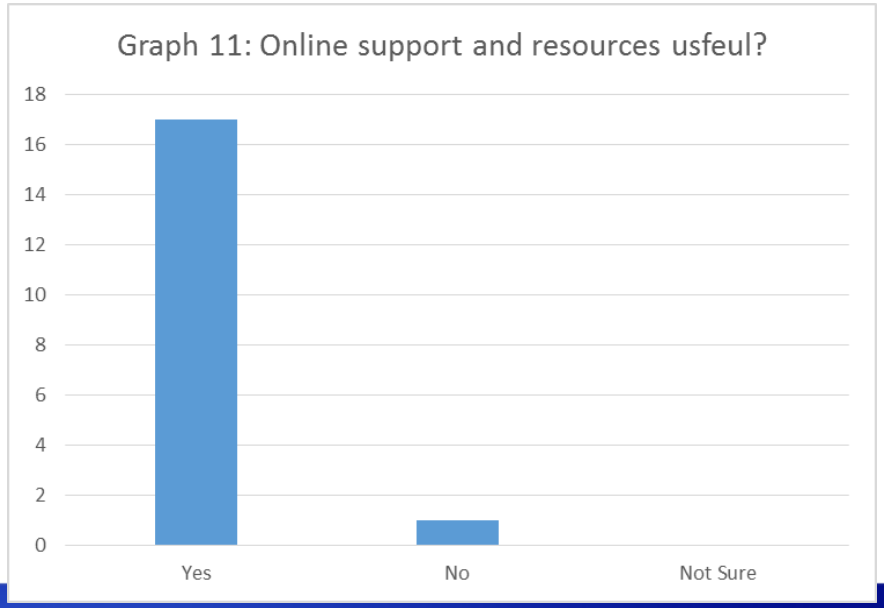


Staff Subject Knowledge

Early Impact







Data Shows 8 Key Impact Themes

Importance of a great package of CPD for staff back at school

School are receptive: enjoying well structured ideas in small steps

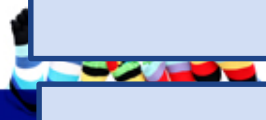
Maths Leads are more confident in challenging ideas with staff

Opportunity to Deepen Subject Knowledge of ML and their school

Actually 'teaching' Times Tables now

Moving away from class by class random ways of teaching TT

Developing consistency across school



Children and Staff using specific vocabulary was a 'game changer'

The Journey So Far

Cohort 1 (2017/18):

- 19 teachers completed
- *e*TimesTables Group for Cohort 1 Alumni
- Case study - 15% of Cohort 1 into year 2 in their own setting
- Attendees now providing sessions for other Maths Leads

Cohort 2 (2018/19):

- 50 teachers almost completed – including two whole Academies
- Pioneer Academy Times Tables Steering Group
- Presentation at Conferences

Cohort 3 (2019/20):

- New cohort of 40+ schools
- Roll out to other Maths Hubs – 'Training the Trainers' Model
- In talks with United Learning (Cumbria to Kent 40,000 children)

MA Article for the Autumn Term
Article in Research in Mathematics Education 2020
Presenting at Conference e.g. MA/ATM 2020

Whatever we feel about the new MTC …
(and believe me I am not a fan of the test itself!)

It IS an opportunity to ***reflect on our curriculum*** *and make positive changes in an area that has probably* ***not had enough focussed attention*** *in the past*

We ***must not return to drill and practice without understanding***

'Take it home on a Friday for a test on Monday'
'Stand up if you got 10 out of 10'
Not acceptable as a school approach