SHANGHAI SPECIAL

MathsHUBS Central

Welcome to this special edition newsletter from the Central Maths Hub reflecting on the visit of our two Shanghai colleagues Chen and Murphy. We thank Colmore Infants School and Colmore Junior School (especially Alison Spicer and Andrew Raine) for hosting our Shanghai teachers and accommodating the vast numbers of you who have had the opportunity to observe the Shanghai teachers first hand. Over **80 teachers** observed the Shanghai style lessons. Within this newsletter we will share some of the key findings and think about the implications for us as we continue to develop our collective understanding of mastery. We hope you enjoy reading this newsletter.

The Central Maths Hub Team

MEET THE SHANGHAI TEACHERS

Our two primary school teachers from Shanghai arrived in the UK on February 22nd for a three week period. During this time they taught maths at Colmore Infant School and Colmore Junior School in Birmingham to a year 2 and year 5 class.

Ms Chen Mohua and Ms Chen (Murphy) Yiyi worked and taught alongside Andrew Raine and Alison Spicer, from Colmore Infant and Junior School, who went on a research visit to No. 2 Central Primary School and Cao Guagbiao Primary School in Shanghai in September last year.

The exchange is part of a project, funded by the Department for Education (DfE), to help English primary school teachers understand and implement some of the key elements of Shanghai maths teaching that have proved so effective in helping school pupils in Shanghai reach levels of attainment far ahead of their counterparts in England and the rest of the world.

Thirty teachers from Shanghai are currently working in 17 different Maths Hub areas around England. This is the second wave of teachers from Shanghai to visit England as part of this project. The first wave, last November, covered the other 15 Maths Hubs.

Central Maths Hub @CentralMathsHub 6 Mar
Yesterday our Chinese teachers taught place value at Colmore school. UK Place Value no problem the Shanghai way. #shanghaimaths @MathsHubs

Central Maths Hub @CentralMathsHub 6 Mar
"Loved being a part of the Shanghai visit. It was great to see the theory being put into practice. Feeling inspired" #mathshubs

Robert Wilne @NCETMsecondary 10 Mar
Great examples of procedural variation in #Shanghai_Maths lesson @CentralMathsHub @ncetm. All y2 made clear progress. pic.twitter.com/UR3EavCotk

Central Maths Hub @CentralMathsHub 13 Mar
"The answer is only the start" #shanghaimaths @MathsHubs @NCETM
Expand

Central Maths Hub @CentralMathsHub 13 Mar
"A very insightful session into how mathematics is taught in Shanghai and how we can assess out practice in the UK" #shanghaimaths @NCETM

MASTERY

"ALL THINGS ARE DIFFICULT BEFORE THEY ARE EASY."

The NCETM have published a discussion paper on Mastery which can be found at

www.ncetm.org.uk/resources/45775

Some key points from the NCETM are distinguishing between:

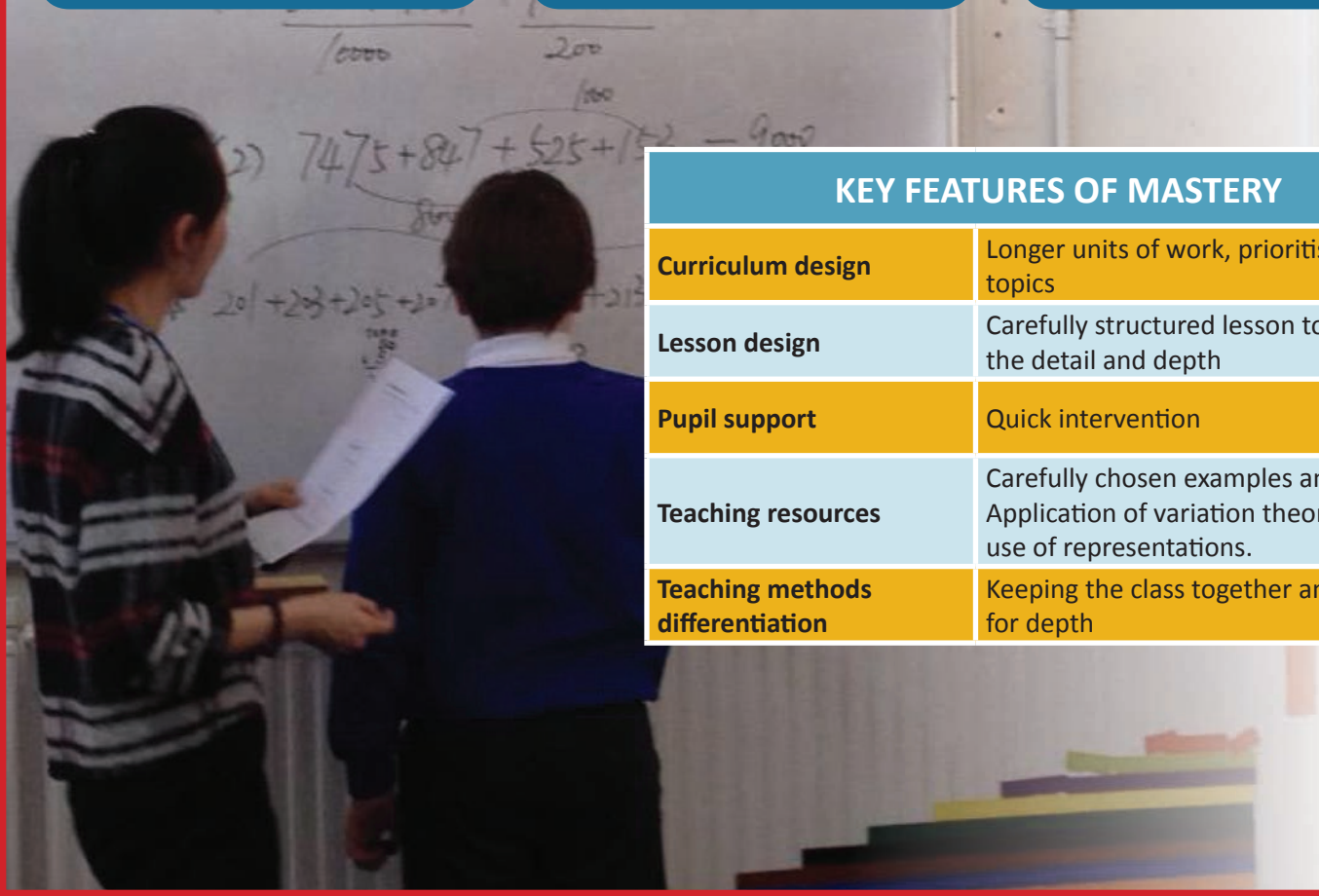
- A 'mastery' approach
- A 'mastery' curriculum
- 'Mastery' of an area of mathematics

The NCETM provides the following guidance:

A 'mastery' approach; a set of principles and beliefs. This includes a belief that all pupils are capable of understanding and doing mathematics. Pupils are neither 'born with the maths gene' or 'just no good at maths'. With good teaching, appropriate resources, effort and a 'can do' attitude all children can achieve and enjoy mathematics.

A 'mastery' curriculum; one set of mathematical concepts and big ideas for all. All pupils need access to these concepts and ideas and to the rich connections between them. There is no such thing as 'special needs mathematics' or 'gifted and talented mathematics'. Mathematics is mathematics and the key ideas and building blocks are important for everyone.

'Mastery' of an area of mathematics; mastery is not just being able to memorise key facts and procedures and to answer test questions accurately and quickly. Mastery involves knowing why as well as knowing that and knowing how. It means being able to use one's knowledge appropriately, flexibly and creatively and to apply it in new and unfamiliar situations.



KEY FEATURES OF MASTERY	
Curriculum design	Longer units of work, prioritising key topics
Lesson design	Carefully structured lesson to develop the detail and depth
Pupil support	Quick intervention
Teaching resources	Carefully chosen examples and activities. Application of variation theory. Effective use of representations.
Teaching methods differentiation	Keeping the class together and aiming for depth

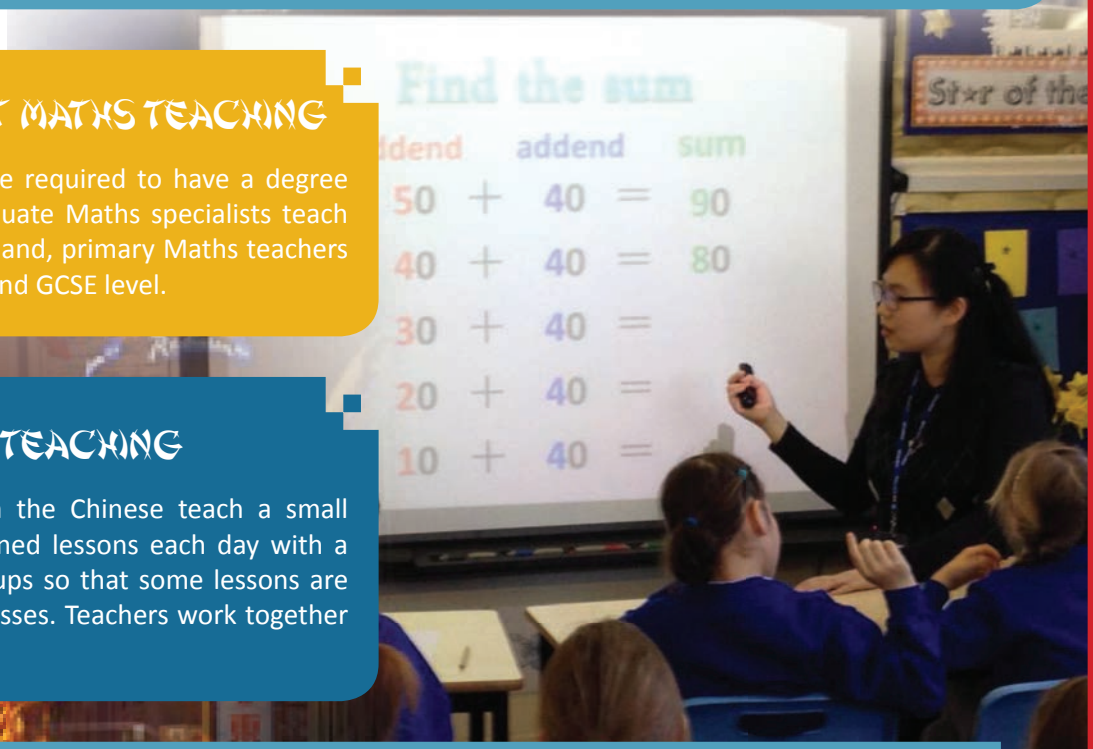
THE SHANGHAI APPROACH

"A NATION'S TREASURE IS IN ITS SCHOLARS."

The National College's International Maths Research Programme (Phase Two) saw 50 SLEs travel to Shanghai to investigate approaches used in Chinese schools achieving top international rankings. The key findings highlighted five distinct, deeply rooted practices that define the Shanghai approach:

SYSTEM 1: PRACTICE AND CONSOLIDATION

Early training in number is the basis of all Maths learning with constant formal practice and repetition so that children demonstrate an assured fluency of use which supports accelerated progress. Mastery is achieved, not through reliance on repetitive drills, but through a rich variety in styles and approaches of practice questioning.



SYSTEM 2: SPECIALIST MATHS TEACHING

In order to qualify, teachers are required to have a degree in their specialist subject. Graduate Maths specialists teach primary Maths, whereas in England, primary Maths teachers are unlikely to have Maths beyond GCSE level.

SYSTEM 3: EFFICIENT TEACHING

Low class contact ratios mean the Chinese teach a small number of collaboratively planned lessons each day with a smaller spread of teaching groups so that some lessons are repeated with the same age classes. Teachers work together rather than in isolation.

SYSTEM 4 IMMEDIACY OF FEEDBACK AND INTERVENTIONS

Maths is taught in the morning: work is marked and returned by the end of the day. Prompt assessment supports rapid progress. Homework, handed in at the start of the day, is marked in time for the lesson later that day- a virtuous cycle of assessment supporting learning.

SYSTEM 5: PREVENTING RATHER THAN CLOSING THE GAP

Children are given additional help before they can fall behind, in the belief that everyone is capable of learning and that there are no intellectual boundaries to knowledge. Whereas in Shanghai, children work immeasurably harder than their teachers, in England the opposite is true.

(Source: NCTL Report on International Maths Research Programme China 2014)

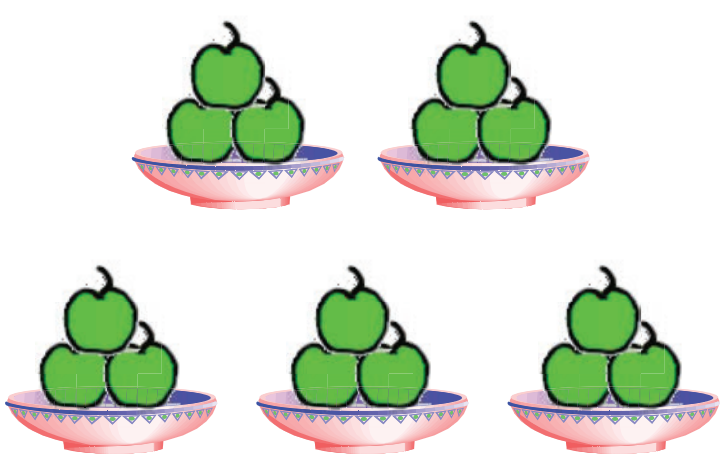
LESSONS FROM THE LESSONS

"THE ANSWER IS ONLY THE BEGINNING"

Over the course of the exchange a number of observation sessions were arranged for teachers and other educators. Below are a number of extracts from some of these lessons. More information can be found in the Central Maths Hub online community.

www.ncetm.org.uk/community/13370

Each observation lasted for around 35 minutes and was followed by a teacher review group where the observers and the Shanghai teachers met to discuss the finer points of the lesson.



What can you see?

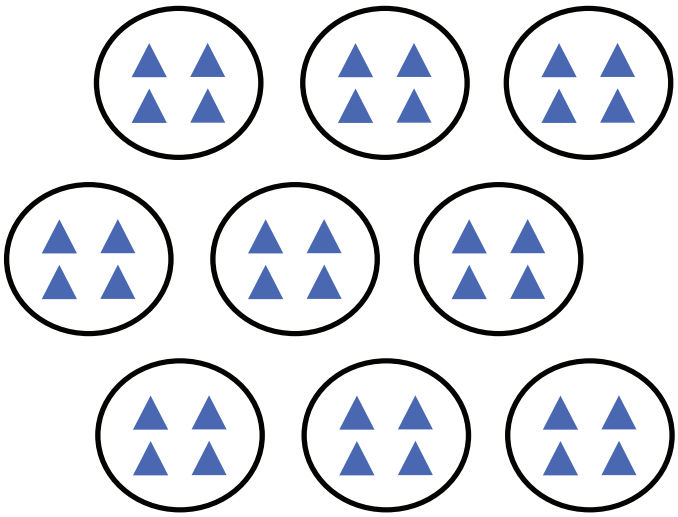
How many apples are there in this picture?

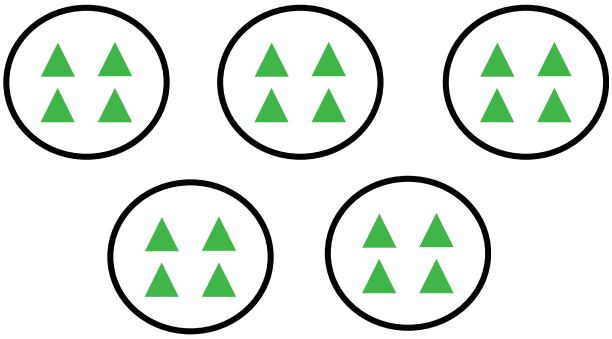
Write your number sentence.

5 threes add 3 threes is 8 threes, 8 threes is 24!

5 threes is 15, 3 threes is 9, 15+9=24.
There are 24 apples.

SAY AND WRITE...





Think: (9) fours add (5) fours equals (14) fours.

Number sentence: (9) x 4 + (5) x 4 = (14) x 4 = (56)

YEAR 5 FRACTIONS

"We observed a lesson in Y5 on fractions. The lesson title was 'Part Whole' and it was the second lesson in a series on fractions. The lesson began with a review of the previous day's learning and looking at a map of China as the part/whole relationship was revisited.

Children then began cutting up A4 coloured paper into any number of pieces up to five. The children did this in various ways; some cutting the paper carefully into four by cutting down the middle and then again, others cut a variety of shapes with curved lines and anything from two to five pieces. They then stuck the pieces back into the original rectangular shape and compared what they'd created.

The teacher called upon several children to show the class what they'd done and to classify the pieces by deciding if they were the same or different. These were stuck on the wall for all to refer to throughout the lesson. There was no mention of fraction names and no fractions were written.

As the lesson continued, children were shown images of swans on the interactive whiteboard of different colours, then shapes of different sizes and colours, followed by cartoon characters of different sizes and colours. Each time they were asked to classify them and asked if they could be sorted into equal groups.

During our post-lesson discussion we discovered that fractions are not taught in Shanghai until Year 4, whereas in this country we introduce them to children in Year 1, or sometimes earlier.

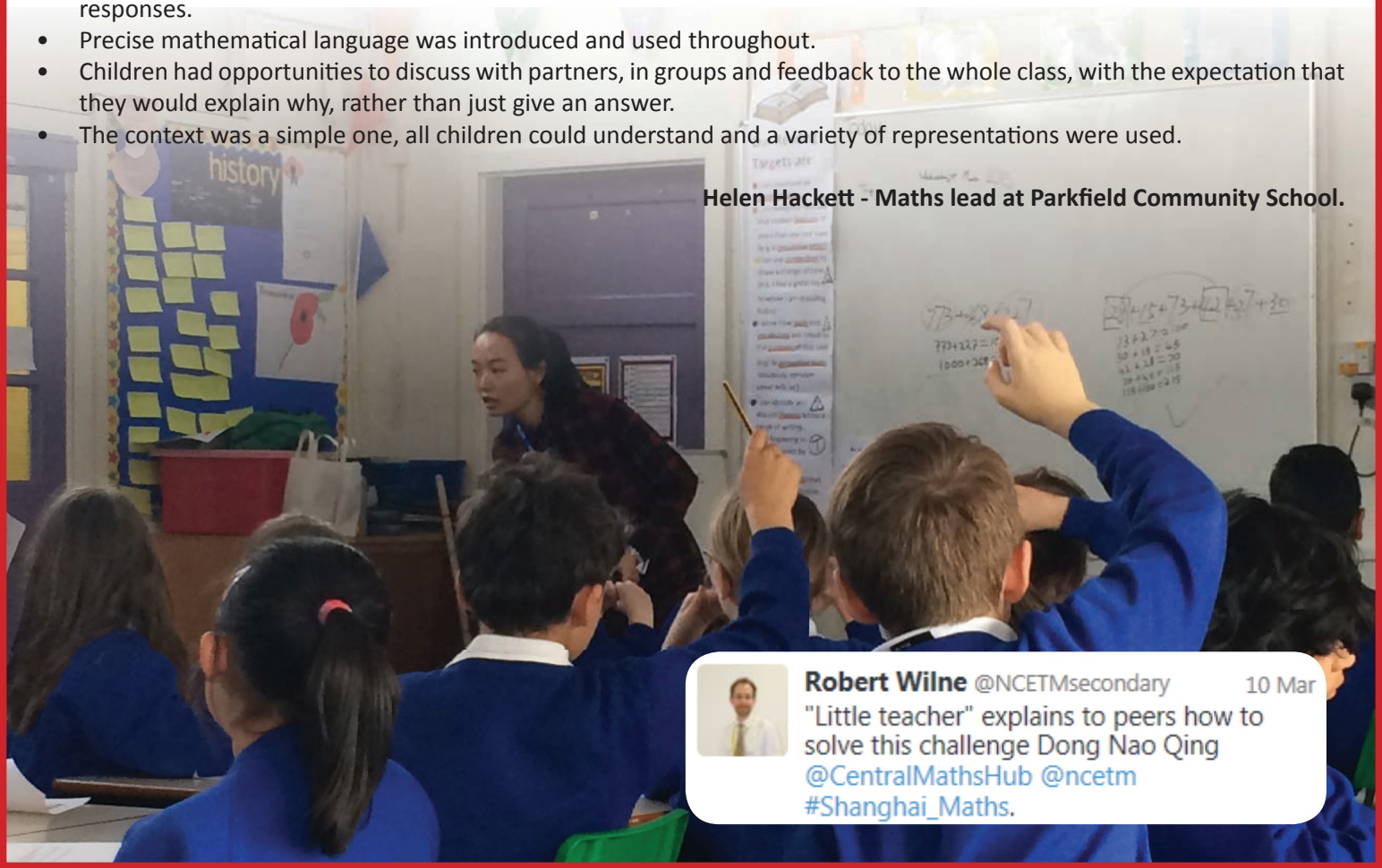
The Chinese teachers told us that when teaching this lesson in Shanghai, to their own students, who they obviously know far better and in their own language, that the pace would have been faster and the children would have moved on quicker. They planned to introduce unit fractions in the following lesson and begin writing fractions such as 1/2 1/4 1/3 1/5.

I believe the teachers had decided to revisit fractions from the beginning to ensure all pupils had a deep understanding of what a fraction is, before progressing to more advanced concepts. Fractions are known to be an area of concern for many in this country and in the National Curriculum the expectations for fractions have been raised, so it is vital that children develop this deep understanding in order to avoid misconceptions later."

KEY FEATURES OF THE LESSON

- The introduction to fractions through a simple, practical activity which all children could complete in a variety of ways with no right/wrong outcome. The teacher guided the discussion through the use of questions and sometimes reframed responses.
- Precise mathematical language was introduced and used throughout.
- Children had opportunities to discuss with partners, in groups and feedback to the whole class, with the expectation that they would explain why, rather than just give an answer.
- The context was a simple one, all children could understand and a variety of representations were used.

Helen Hackett - Maths lead at Parkfield Community School.



YEAR 2 PLACE VALUE

"I was fortunate enough to be able to observe a Year 2 lesson at Colmore Infant School this week, led by one of the visiting teachers from Shanghai.
The Year 2 pupils had been organised into ability 'sets', and this group was set 3 of 4 (4 being the least able). The lesson focused on place value, and had been planned as a result of assessments carried out to indicate gaps in understanding.

The lesson was entirely led from the interactive whiteboard, and began with the whole group singing a song together entitled 'two fives make ten'. Several of the observing teachers were surprised at the low starting point. The teacher provided examples of questions where a multiple of ten is added to a single digit number (e.g. 6 + 80). The emphasis was very much on the mathematical language and children verbalising full sentences when explaining their answers. Representations changed, although the mathematical content stayed the same;

e.g. "( ) tens and ( ) ones equal 25" and "In 39, the 9 on the ( ) of 39 is in the ( ) place. It means ( )"

Individual children were expected to stand up when they answered a question, and the rest of the class were encouraged to listen carefully. 'Desk partners' were utilised for discussing content from the teacher, or responses from peers.

The role of the TA was changed due to the layout of the classroom and structure of the lesson. The TA was restricted to working with just the children either side of them as they too were sat in a formal row.

Great emphasis was placed upon teaching that the value of digits is determined by their place in a number. "does the same number in a different place have the same meaning?" (showing 73 and 37). There was a great deal of structured discussion throughout, but there were no physical, concrete resources to show a visual model of the structure of the number, e.g. Dienes blocks etc.

A 'real life' context was used to show how 'one' relates to 'ten' to 'hundred'. A clear visual of 10 'blocks' of bread being placed into a bag and ten bags being placed into a box was used and the connection made between the representations. Throughout this the teacher was very consistent in the use of language, repeating key words and using complete sentences.

A 'Numerical Chart' was displayed (10 x 10 array of circles with lines drawn horizontally and vertically half way down/across the grid).The first line of circles were coloured and the children were asked to say the number. This was displayed as " 1 ten – 10 – ten". This was repeated down the grid, all the way to 100 "2 tens – 20 – twenty" "3 tens – 30 – thirty" etc with children saying the numbers aloud, in the different forms. On reaching '50', one child was heard to say "we're half way down, if I add another 50 I get 100, or half of 100 is 50". Although this comment was heard by the teacher, it was not built upon. The same chart was used to highlight additional rows to support children in adding ten onto a multiple of ten, e.g. 30 + 10 = 40, 40 + 10 = 50 etc, again all the way to 100.

Children were asked to look for patterns at several points throughout the lesson and to discuss their observations with their partners. These were then identified by the teacher and explained clearly. One child said that because 5+4=9, then 50+40=90… the teacher explained this fully, stating "5 tens add 4 tens equals 9 tens", reminding the child to 'talk mathematically'.

It was impossible to miss the continual repetition of accurate mathematical language during the lesson, by both the teacher and the children. It was entirely teacher-led, from the front of the room, and the children did well to focus for what was an hour's lesson. The teacher explained afterwards that lessons in Shanghai would normally be only half that length.

The search for pattern and the expectation to explain those patterns was embedded throughout with the clear sequence of representations and questions bringing the mathematical structure to the surface."

KEY FEATURES

- The lesson had been planned as a result of assessments carried out to indicate gaps in understanding.
- The emphasis on the mathematical language and children verbalising full sentences when explaining their answers.
- Representations changed, but the mathematical content stayed the same.
- Consistency in the use of language, repeating key words and using complete sentences.
- Searching for patterns and the expectation to explain those patterns bringing the mathematical structure to the surface.

Louise Burnett, Mathematics Consultant, Bright Pi Ltd.

YEAR 5 CALCULATIONS

The lesson began with these calculations on the board:

531 + 758 + 469

1292 + 324 + 708

and a discussion followed on how best to do these calculations quickly (i.e. finding pairs to make 1000 or 2000) and which law of addition they have used. Pupils answered that they had used the commutative law to transform the calculations.

Then 416 + 857 + 143 (on the board), followed by 773 + 368 + 227 (on a worksheet). Further whole class discussion about how to do these quickly and what law of addition was being used. Pupils suggested 'commutativity' again but the teacher drew their attention to the fact that, in the first example, the addends were combined by calculating 416 + (857 + 143) rather than (147 + 857) + 143 and that this was the associative law.

Almost every time the teacher asked the pupils to give an answer, she followed it with 'why?' and expected the children to speak in full mathematically correct sentences to explain what they had done.

The emphasis was on looking at the structure of the calculations to arrive at an answer quickly without lengthy computation.

The teacher used a number of different scenarios within which this same theme was explored – e.g.

- A range of calculations and their answers - true or false?
- A range of correct answers – which is the most efficient?

The teacher circulated around the room while children worked through a worksheet of calculations (not excessively long, just very well chosen examples), checked for understanding and selected work for pupils to write up on the large white board. On other occasions she used the visualiser to get children to show and explain their work to the whole class. Each time the children's work was chosen carefully in order to highlight particular efficient methods and to compare and contrast different methods.

The teacher paid very careful attention to correct use of spoken and written mathematics, including correct use of the equals sign.

The lesson finished with a challenge:

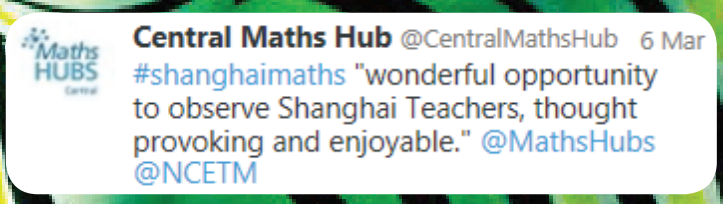
9999 + 999 + 99 + 9 + 5

Children worked in pairs to solve this and then a couple of children were chosen to come and demonstrate to the whole class what they had done and explain their thinking.

KEY FEATURES OF THE LESSON

- Pupils were expected to speak in full mathematically correct sentences to explain what they had done.
- Exercises provided were not excessively long, just very well chosen examples.
- Pupils work was chosen carefully in order to highlight particular efficient methods and to compare and contrast different methods.
- Careful attention was given to correct use of spoken and written mathematics, including correct use of the equals sign.

Pete Griffin, NCETM



QUOTES FROM TEACHERS

"TEACHERS OPEN THE DOOR. YOU ENTER BY YOURSELF."

"The children were asked to complete a word problem on their worksheet. The question asked the children to estimate the answer and then solve the problem. The question required the children to add 274 amphibians and 399 reptiles to find the number of animals. These numbers were selected because they linked to the key learning point of the lesson which was 'to calculate in an easier way', i.e. compensation. The teacher moved around the room supporting individuals.

Once all had completed the task the solution was discussed in detail. The teacher encouraged the children to think about which method was efficient by using questions such as 'Calculate in your mind, why can you do it quickly?' The children were taught the correct mathematical vocabulary which they read out together e.g. addend + addend = sum and briefly discussed the 'commutative law' and 'associative law'. Precise language was used throughout."

Claire Duncan – Worlds End Junior School

"The Year 2 lesson on place value began with some lovely visual imagery and precise use of language. Careful attention was given to numbers that the children were familiar with; in this case starting with understanding that 11 is made up of 1 ten and 1 one and, through other examples, developing understanding that the digit on the left represents the number of tens and the digit on the right represents the number of ones.

Our English number names aren't very helpful here; 'eleven' rather than 'one-ten one' as in other languages where the place value is more transparent. The children engaged in lots of talk and wrote very little, which was interesting to see. I especially welcomed the opportunity to discuss the lesson with the teachers afterwards, and thank everyone who was involved in organising (and teaching!) for a stimulating morning."

Kirsty Wilson – University of Birmingham

Thoughts from Alison Spicer (Head of School Colmore Infant and Nursery School) and Andrew Raine (Maths Lead of Colmore Junior School.)

"The lessons are really well structured with very simple steps for the children to follow. They are encouraged to verbalise their answers and how they achieved them.

- **"How did you get the answer?"**
- **"What do you notice the numbers?"- children encouraged to find the patterns.**
- **"Do it quickly."**

The children are encouraged to complete the number sentences at the end sessions using the knowledge they have been taught during the session. This is very powerful and the children are beginning to be able to complete number sentences using patterns and also concepts taught in the lesson. At the beginning of each lesson the children recap on work from previous sessions and this is referred to during the whole period. There are limited scaffolds for the children to use to complete problems but no work is given unless the children have first been given clear guidance and support in the concepts and strategies needed to complete the problems."

"I really enjoyed watching the pupils apply their new knowledge in lots of contexts. I was also struck by the chanting, the precise and complex language and the constant reinforcement of the key idea. These kids are going to be amazing at expanding/factorising/manipulating algebra when they are in secondary school!

I asked one pupil what she thought about the lessons she had received, she answered; 'We do a lot of explaining to each other and I really like that the teacher makes sure we all understand before she moves on.' "

Elizabeth Bridgett Maths AST and SLE at Kings Norton Girls' School

"On aspect of the lesson looked at the use of a place value grid where dots were used to represent 10's and units to write the numbers. E.g. if there were 2 dots in the 10's and 3 in the units the number would be 23. The first set of questions had dots completed and the children had to write the number. The next set had the number and children had to draw the dots. There was some careful choice of questions e.g. 26 and 62 as the numbers to form through dots and or to write. There was detailed discussion with the children on what they noticed about these two numbers and what each number which formed these numbers was valued like the 2 in 62 and in 26.

Questions asked as part of the tasks in this lesson challenged common misconceptions; it seemed the tasks were designed to pull out and consider common misconceptions that occur around place value."

Pinky Jain - University of Worcester

PUPIL VOICE

"A CHILD'S LIFE IS LIKE A PIECE OF PAPER ON WHICH EVERY PERSON LEAVES A MARK."

Most importantly, what did the pupils think of their Shanghai style lessons? Here are some quotes from year 2 and year 5 pupils at Colmore Infants and Juniors.

"The **talking helps** us to know what to do."

"**Really fun**, I like counting in 10's. I like the songs and the sums. Different to English lessons."

"Starting to get into maths."

"Explains it really well."

"It's just fun!"

"**I love it** – easier stuff to do. Explains it and **makes it simple** for me."

"Never get bored"

CHALLENGES FOR TEACHERS IN IMPLEMENTING ASPECTS OF THE SHANGHAI APPROACH

"DEEP DOUBTS, DEEP WISDOM; SMALL DOUBTS, LITTLE WISDOM."

The approaches seen in Shanghai are interesting and there is a lot we can learn from them. Significantly though, there are challenges associated with the structure of our education system and our culture generally that means some things will be easy to implement whilst other things need to be adapted to fit our own context.

What can not be denied, however, is that there are plenty of excellent ideas and approaches to teaching stemming from Shanghai that pupils in our own schools would benefit from greatly. The key is to think about our own context and be open to change and professional learning.

Some of the **key challenges** seem to be:

- How can challenge be introduced if students are all given the same tasks to complete?
- With whole class teaching how do we keep the pupils engaged?
- What happens to differentiation within a mastery approach?
- How do we facilitate time to allow for more collaborative planning and lesson study?
- How does this approach fit with our own programmes of study?
- What would OFSTED say?

On the final point, interestingly, OFSTED have quite a lot to say on the inspection of mathematics teaching. Their recent handbook makes specific reference to mastery teaching and the inspection of mathematics as outlined in the new National Curriculum,

"The expectation is that the majority of pupils will move through the programmes of study at the same pace."

"Decisions about when to progress should always be based on the security of pupils' understanding and their readiness to progress to the next stage. Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on."

WHERE NEXT?

These challenges have to be the start point for more discussion around Shanghai approaches and the wider adoption of mastery teaching. As we continue to develop our understanding of the New National Curriculum it is important that teachers share ideas and are given the opportunity to engage in professional learning in whatever form this takes.

HOW TO FIND OUT MORE ABOUT THE ENGLAND CHINA RESEARCH AND INNOVATION PROJECT?

"DO NOT FEAR GOING FORWARD SLOWLY; FEAR ONLY TO STAND STILL."

The end of this exchange by no means marks the end of the England-China project. The opportunity to observe the Shanghai teachers in action and the rich conversations had between teachers in the review sessions will, hopefully, act as the springboard to continue these discussions further and develop a collective understanding of mastery pedagogy that takes cognisance our own educational systems whilst being open to trying out new approaches.

EMAIL

If you have an idea as to how the lessons learnt from Shanghai can be further embedded within your own setting or you would like to try out some of the Shanghai methodologies, please let us know.

mathshub@bishopchalloner.bham.sch.uk

ONLINE COMMUNITY

You can continue the Shanghai discussions through the online community where links to resources, videos and other teachers' posts can be found.

www.ncetm.org.uk/community/13370

WEBSITE

The Maths Hub website also contains information on the England China project and will be updated regularly as the project moves towards year 2.

www.mathshubs.org.uk/

TWITTER

Of course you can also always tweet us

@centralmathshub