Using Shanghai principles to improve fluency in place value in year 1.

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Why did you choose to develop mastery and fluency?

I choose to develop mastery and fluency because it was clear from our Ofsted inspection and our data that our children were underperforming in KS2. Generally we found that our children tended to make good progress in KS1 and then struggled in KS2.

After drilling down into the reasons for this, it was evident that the children had not fully mastered concepts and therefore, in KS2, needed to fill in gaps before teaching the year group content.

In addition to mastery, the children's learning was not sustainable so, although they may have achieved all the statements in a prior year group, the children tended to dip after the summer holidays. There were other reasons as well, but this was my main inspiration in trying to develop Mastery and fluency.

One of the main reasons the learning was not sustained was because teachers were rushing through topics so that they could cover all areas quickly and still have time to recap if children had not achieved the statements. However from doing this, we are actually not providing children enough time to practise a new learnt skill so that it is embedded and so that the learning is sustainable. In our most recent Ofsted it was highlighted that calculations were a weakness at our school and therefore we needed to change something so that the children do not suffer from this.

With the change in curriculum, there is also greater emphasis on children solving multi-step problems. This is much more achievable if the children are fluent in key mathematical facts, because they do not spend the time working out each individual step but instead solve the problem by piecing all the bits together.

Both mastery and fluency are vital for children to be truly successful in mathematics.

In what way were you planning to develop Mastery in fluency?

Prior to this project, I attended training on 'Shanghai Maths'. We decided to take concepts from this and embed them into the teaching in Year 1 as a trial. If the trial was successful after a half term, then it planned to be embedded within other year groups too. It is important to note that when referring to 'Shanghai Maths' I am referring to my interpretation of the training and how we adapted principles of it to suit the needs of our children.

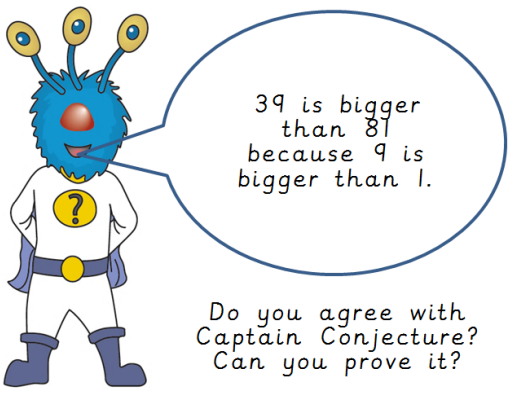
The main features we tried in year 1 were:
-Slowing down the curriculum (teaching one area for a whole half term).
-Whole class teaching.
-30 minute input with a 30 minute practise session later on in the day.
-No differentiation or next steps.
-Repetition of key language and facts.
-Practising when lining up etc.
-Speaking in full sentences.
-Problem solving and applying.
-Reasoning opportunities
-Variety of representations.
-Intelligent variation.
-Immediate interventions.

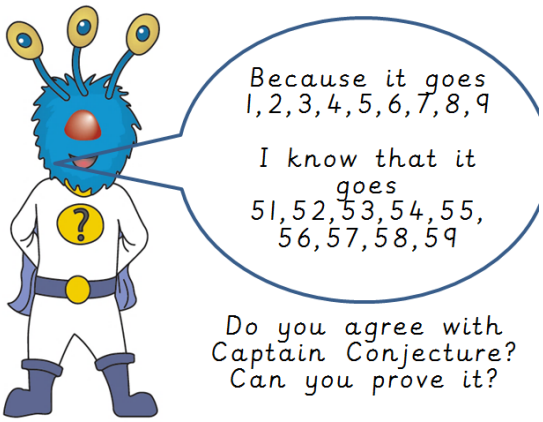
What did your project involve?

My project involved using the principles of 'Shanghai Maths' to improve mastery and fluency for children in year 1. It consisted of 2 year 1 classes with roughly 30 pupils in each class. At the beginning of the project the majority of children were still on foundation steps and there were 4 steps difference between the highest attaining child and the lowest attaining child.

Covering less and 'slowing down' One of the key features we adopted was slowing down the curriculum. We spent a whole half term teaching place value which is my main focus for this project. Another feature was whole class teaching with no differentiation or next steps. The aim of this was to lessen the gap and enable all children, especially vulnerable children, to access the mathematics. Sometimes, by differentiating, we were placing low expectations on some children which prevent them from achieving their potential. Since we were teaching the whole class the same concepts, next steps became irrelevant because the next lesson would theoretically be the next step for every child. The children who could complete the work set were given challenges which deepened their understanding of the concept rather than moving them on to a new concept.

Captain Conjecture Each lesson began with a 'captain conjecture' statement that the children had to discuss to develop their reasoning skills. (See figure 1 below). We then had a 30 minute input with the children using resources and practising on the carpet. During this time we would mentally assess the children and then when practising later in the day we would work with those children to provide immediate intervention.





Repetition Within the lessons we used lots of repetition to help the children embed the knowledge being taught. This repetition might be for mathematical terminology or to remember key facts or to simply practise what we have been learning. This also supported the children in talking in full sentences and we set expectations that they should explain why with each comment. We began chanting outside of the mathematics lesson too; when lining up for lunch, whilst waiting for parents, whilst walking to assembly.

Representations When learning concepts we used various representations and resources to model it to the children to support conceptual understanding (See figure 2 below). This also followed the 'connective model' where we moved from concrete to pictorial to abstract within quick succession (See figure 3 below). Children's work consisted of some intelligent variation to support the children in spotting patterns and making their own conjectures and generalisations (See figure 4 below). Every lesson would contain a task for all children to complete, those who completed it independently would then move onto a challenge. If a child has not fully understood the task then they would either receive immediate intervention within the lesson, or additionally intervention later that day with a TA. This meant that we changed our marking for year 1 to show clearly who understood the task first time and who needed extra support (See figure 5 below).

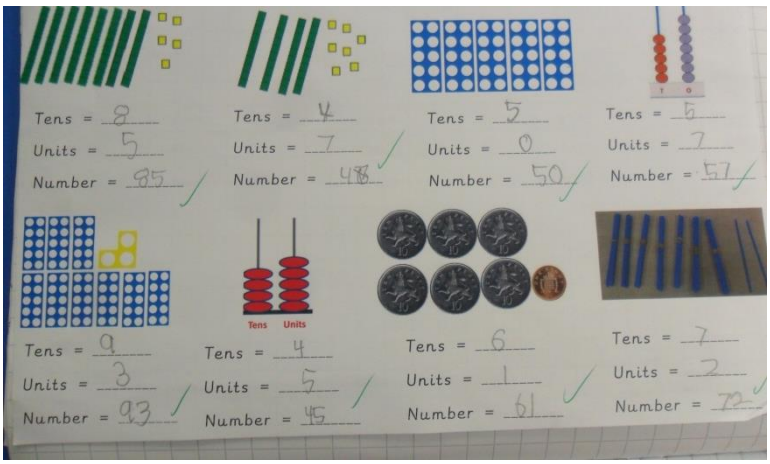


Figure 2 – Examples of various resources to support conceptual understanding. (Concrete versions were also used.)

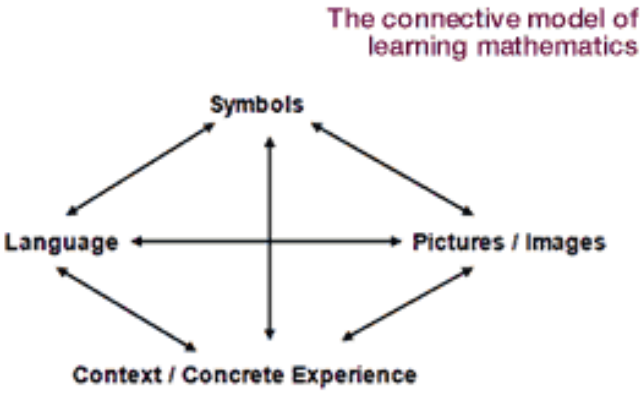


Figure 3 – Connective model. (Haylock and Cockburn)

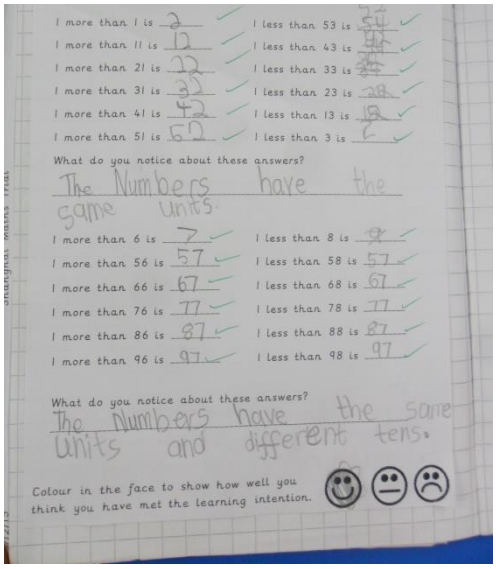


Figure 4 – Examples of 'intelligent variation' to help children spot the patterns and use them to make their own conjectures and rules.

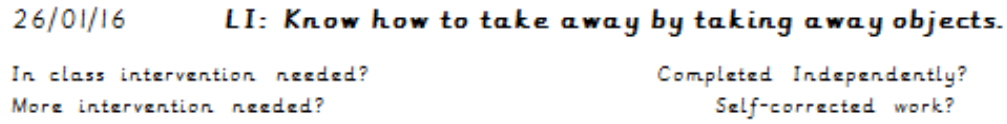


Figure 5 – Example of our marking for 'Shanghai Maths'. We highlight green if independent or self-corrected. We highlight pink if intervention is needed. The LI is highlighted green once it has been achieved.

What did you find out throughout carrying out the project?

Spotting patterns Through slowing down the curriculum, children were able to master a concept. Children were able to spot the patterns and apply it to harder numbers. For example, children could see the connection between 1,2,3,4,5,6,7,8,9, and 51,52,53,54,55,56,57,58,59. When asked what other numbers this pattern applied to, responses included 101, 102, 103…. 1001, 1002, 1003…. 1000001, 1000002, 1000003….. Although two of the children still struggled to count to 100, they were confident reading and writing numbers to 20 and could see the pattern to write the numbers up to 100. Previously, it is unlikely that these two children would have worked with numbers higher than 20 due to differentiation. This was then supported by intelligent variation where the children were given specifically chosen questions that linked to each other to support fluency and the ability to spot connections.

Keeping the class together- No differentiation Through whole class teaching with no differentiation there were 4 children on my lowest table that achieved all the place value statements taught, which I do not believe they would have otherwise. Two of those children have mastered the concept of place value, at a year 1 level. Not every child has mastered the concept of place value but a large majority of the class can count, compare, read and write numbers up to 100. A smaller majority of the class have mastered the concept and are able to apply their understanding to other numbers as well as using mathematical terminology to describe the numbers.

Organisation of lessons and intervention We started off teaching 30 minute inputs, teaching a different subject and then having a 30 minute practise session late that day. We did not see a benefit to this structure and it tended to cause timetabling issues. It also made the morning seem longer for the children as they then had 3 intense shorter lessons. Therefore we stopped this feature of 'Shanghai Maths', however we kept the longer input as it gave children chance to practise the maths with more opportunities to talk and with the whole class discussing how they worked it out. The children who were unable to complete the task in class either had immediate intervention in class. Those who still had not grasped the concept had intervention that afternoon with my TA. This then meant that all children were ready for the next lesson and that gaps were closed immediately rather than waiting until it was too late. I think this was very beneficial for the children and it was interesting to see that it was not always the same children who needed intervention. The immediate interventions were difficult to fit into the day, however over time there were less children who needed intervention which made it more manageable.

Repetition The repetition was brilliant. All children were engaged and enjoyed repeating the facts to various people, teddies, and parts of the classroom. Through repeating the facts and terminology children remembered them much better and were able to recall some number facts instantly. It also encouraged children to speak in full sentences and provided children with concise and simple explanations for why the mathematics worked. For example we chanted 'the tens come first, then the units.' (We discussed that the tens would not always come first when we learn larger numbers, but the tens would still come before the units.) When we were writing numbers e.g 48, I would write the number 84 on the board and the children would instantly tell me I was wrong because the tens come first, then the units. This also then eliminated the misconception that children often have for numbers like 13 when it sounds like the 3 comes first. This was then reinforced by practising outside of maths lessons, where the repetition reinforced their instant number recall necessary for fluency.

Problem solving Our Friday maths lesson became a 'Big Maths' session where the children have a problem or an investigation to solve with a partner. This enabled the children to apply their learning to a problem. Every lesson we started with a 'Captain Conjecture' statement, which the children had to decide if they agree or disagree and explain why. This was brilliant for reasoning skills, but it also addressed several misconceptions. For example, one was 'Captain Conjecture says that 38 is bigger than 71 because 8 is bigger than 1.' This created a lot of discussion and eventually children were able to use the numicon to see that this was not correct and that we needed to look at the tens first. When teaching children place value we used a variety of representations. This included money, abacus, measures, cubes, numicon, number lines, straws, tens frames etc. I found this was great for introducing concepts like money. Previously in year 1 children struggled with the concept that 1 coin can be worth more than 1p. Therefore they often thought that 10p + 5p = 2p because there are 2 coins. Through teaching place value through money, children instantly saw that 10p was the same as 1 ten in other place value apparatus. We then continued this with £10 and £1s.

Findings After the half term, we found that the majority of children had achieved the place value statements for year 1 and a large proportion of them had mastered the concept. Their reasoning and problem solving skills were improved and children were talking in full sentences in all subjects. For steps/levels 2 of the previously 'low' children were the same level as some of the 'more able' children. There was an issue that steps/levels did not reflect true standard because children had only been taught a small proportion of the curriculum. Overall we are happy with the results and have begun integrating these features throughout the rest of the school.

<u>Challenges -How they were overcome and what was adapted to address them.</u>

Timetable One of the challenges we had was timetabling. It was difficult to fit in a 30 minute input, teaching a different subject and then having a 30 minute practise session late that day. We trialled it for about 4 weeks before concluding that we did not see a benefit to this structure and that therefore this was not a feature that we wanted to continue. It also made the morning seem longer for the children as they then had 3 intense shorter lessons. Therefore we stopped this feature of 'Shanghai Maths', however we kept the longer input as it gave children chance to practise the maths with more opportunities to talk and with the whole class discussing how they worked it out.

Assessment Another challenge we had, and still have, is showing progress through steps (our assessment system). Since we are only teaching one area in a half term, the children are only able to 'secure' the year 1 curriculum at the very end of the year when the entire curriculum has been taught. Therefore children's progress is not necessarily measured accurately through steps. For example a child could achieve every statement taught that half term but it may not be enough to make a step's progress. Currently we are addressing this by seeing progress through thorough moderation of the books, assessment grids and teaching. Therefore we are confident that the children are still on track. We are regularly assessing in every lesson and because intervention is immediate, children are still receiving the additional help and support where required.

Higher attainers Another difficulty was challenging the 'gifted and talented' children. The 'more able' children were stretched through the challenge sheet as it involved them thinking about a process differently. However there were two children in my class that the challenge was still not encouraging them to think deeply. Therefore we started having an investigation for children who had completed the other work. (See figure 6 below.)

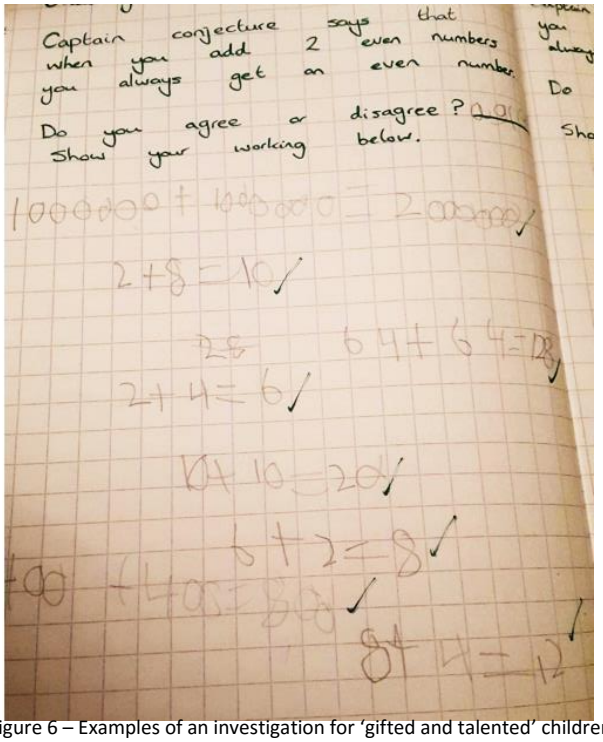


Figure 6 – Examples of an investigation for 'gifted and talented' children.

Other year groups Because the evidence was looking positive we began trying these 'Shanghai' features in other year groups. We found that whole class teaching did not work as well in other year groups, due to a larger difference in steps/levels. However we addressed this through our marking scheme in other year groups that use 'good, amazing, awesome'. Therefore teachers provided 3 tasks for the children in which the children could choose which one to do. If a child is struggling then they would try the easier task, if a child has completed the task they move onto the harder one. This enabled differentiation but where the children choose which task they want to try, therefore children are not prevented from achieving their potential. In other year groups they are still

completing next steps, so if a child completes 'good' then their next step would be the 'amazing' task. We have decided to continue teaching whole class in year 1 with the idea of continuing it into year 2 in September if the trial continues to prove successful.

What differences did it make to your learners?

I found that this project was extremely beneficial to the students involved. Children were all engaged and enjoyed mathematics. Children were choosing to practise their maths outside of the maths lesson. In my class, children get a whiteboard and pen out when they come into school in the morning and can choose what to practise. Often they will practise what we have been doing in maths. Sometimes they try and challenge themselves and stretch themselves and their own learning. Sometimes they try and complete a statement that has not been taught. All children wanted to complete the challenge and would complete work completely and accurately so that they could try the challenge. I found that disadvantaged children made accelerated progress and our pupil premium children made more progress than their peers. Learners generally became confident and independent with their work. Children's reasoning skills improved and children were able to tackle challenging questions. They were not afraid to get the answer wrong and were willing to make guesses as to how to solve problems.

Overall I found that:
-The vulnerable and disadvantaged children made accelerated progress.
-My expectations of the previously 'low' table were higher.
-Children who were previously 'middle' were mastering concepts.
-The children used brilliant language and reasoning.
-Everyone in the class could access the curriculum.
-All children had a better understanding of concepts and could apply it to different areas.
-Children spoke in full sentences in every lesson.
-Children often used the word 'because' without prompting.
-Children became more independent in their learning.

What difference did it make to your school?

We started using these principles throughout the school in January. We carefully designed long term and medium term plans that groups concepts together and allowed for good connections to be made between topics. For example when teaching addition, children would also be taught adding measures, adding fractions, perimeter etc. Therefore they are practising the same skill but in various methods and using different representations. This means that the learning is different but the children are repeating the same skill in different contexts.

The whole school is now using a 'Captain Conjecture' statement for every maths lessons. Each class has a 'big maths' lesson where all children are able to develop their problem solving and reasoning skills. Children are using repetition and variety across the school. We did find that whole class teaching was not effective in other year groups because there were wider gaps. However we adapted this by using our marking policy of 'good, amazing, awesome' to still enable a form of differentiation. If our year 1 trial is successful by the end of the year then we will continue the principles into year 2 in September.

It is still early days with our whole school approach to 'Shanghai Maths' and therefore it is difficult to measure its effectiveness at this stage. However, if the year 1 trial continues to be as successful as it has currently been, then these children will have sustainable learning that can be built on as they continue up the school. The principles that have been embedded into the rest of the school should improve mastery, fluency and reasoning skills for all children but more time is required to confirm this.

What did you learn yourself?

I found this project extremely interesting and revealing. It showed that one of my 'top' children could answer 1 more and 1 less question by rote, but did not actually understand the concept of more and less (see figure 7 below). On the other hand it also highlighted that all children have the ability to achieve age expectation. It taught me that even younger children can reason and explain why and apply their understanding to solve complex problems. Through talking in full sentences children were able to write number sentences instantly. If I asked a child what was 3 + 6. They would reply 3 + 6 = 9 and therefore would be able to write it down as they were saying it.

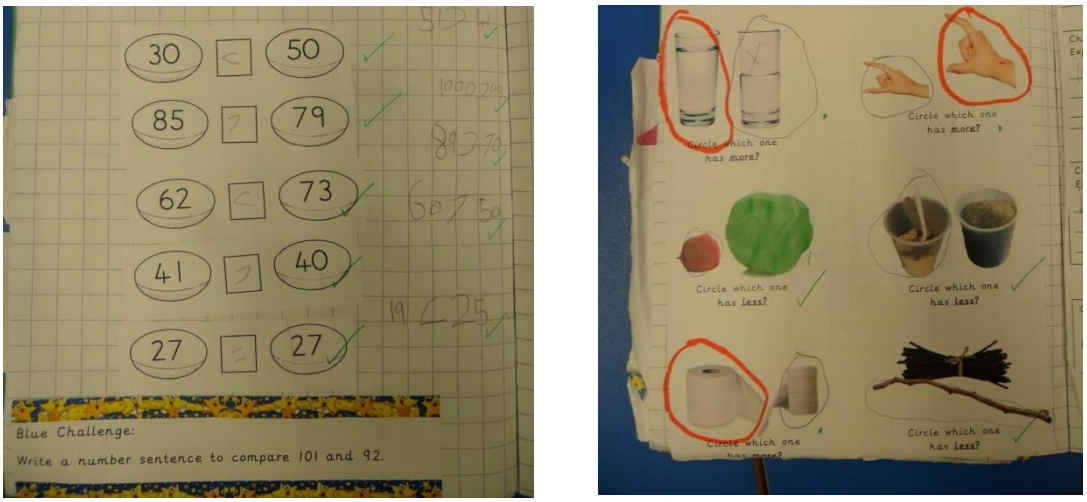


Figure 8 – On the left example of 'more able' child completing work on more, less, greater than, less than and getting everything correct. On the right the same child struggling to understand which picture is showing more and which picture is showing less.

Any other comments

I think that the principles of 'Shanghai Maths' are extremely beneficial, however they do not all fit in with our environment. It is important to note that 'Shanghai' teachers are specialist teachers who only teach one subject and have all afternoon to plan the next day's lesson. That being said the emphasis on reasoning, connections and problem solving has transformed my class into mathematicians. The whole class teaching has enabled all children to have to opportunity to achieve their year group statements. This is something that I strongly support but also think it is important to remember that our children have not been taught in this way previously and therefore it is not suitable to introduce to the whole school straight away. There are definitely some principles that can be easily adopted and used in all classes straight away and are likely to have a great impact on the children.