Improving children's fluency, understanding and application in place value to develop number sense

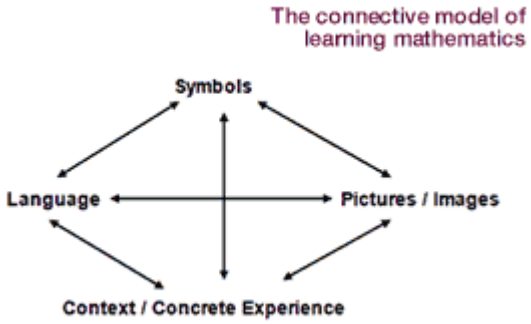
Kents Hill School: An Infant School in Milton Keynes

Aims of the project

1. As subject leader, develop and increase my own understanding of fluency and number sense to support the school in improving outcomes for all pupils.
2. To increase children's fluency in place value and number sense by implementing extra sessions in the week to understand, practise and apply skills in different contexts.

Why I chose this area?

With the introduction of the new National Curriculum there is greater emphasis on the need for fluency, reasoning and problem solving. With this in mind, I feel that fluency in place value and number sense is fundamental in children's progression and development as mathematicians. The school is in the early stages of developing the new curriculum and some work has already taken place using Haylock and Cockburn's connective model (1997), where teachers are developing the use of symbols, pictures and images, concrete experience and language when teaching mathematics and supporting children in making links.



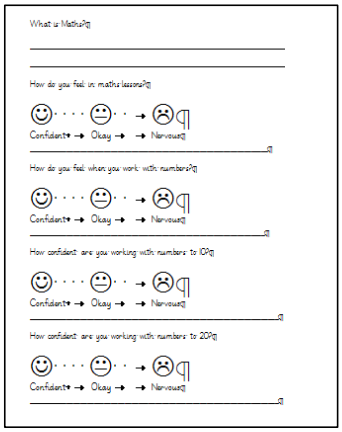
Connective Model Haylock & Cockburn 1997

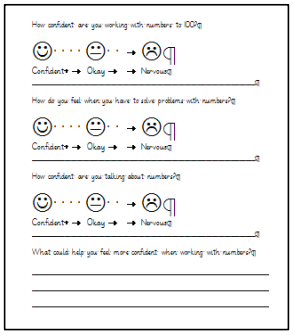
As Maths subject leader I want to improve my own subject knowledge and help our pupils to develop maths fluency in each year group. Having extra time each week to teach place value using the Symbols, Language, Actions, Models and images (SLAM) approach, linked to the connective model, will increase the children's understanding of number and help them make sense and make links in mathematics. This will in turn improve the outcomes for pupils in my school.

Developing the plan

The project plan consisted of planning and developing staff training and coaching support. This involved one staff meeting to introduce the importance of fluency, reasoning and problem solving using the SLAM approach, an opportunity for staff to observe best practice, follow-up observations and coaching opportunities, discussions about how to move forward and another staff meeting to further develop mathematical fluency throughout the school.

The next stage, which ran parallel to the staff training, was to plan and implement three extra 15 minute maths sessions into the Year One timetable, focusing on developing children's understanding and application of fluency in place value and number sense. This involved considering what a fluent Year One child would look like, the skills they would need and how I would know if the project was successful. I also wanted to ask the children how they felt about number, before the project, so I devised a questionnaire to gauge the children's feelings and confidence about maths, particularly number. I asked six children, of different abilities, before and then repeated this at the end of the project.





Children's questionnaire – start of project

When asked;

- 6/6 felt confident in maths lessons and when working with numbers.
- 5/6 felt confident working with numbers to 10 and 20.
- 3/6 felt confident working with numbers to 100, 1/6 felt okay and 2/6 felt nervous.
- 3/6 felt confident talking about numbers and 3/6 felt nervous.
- 2/6 felt okay when problem solving and 4/6 felt nervous.
- When asked what we could do to help, their replies were varied – give us 100 squares, count slower, help me count to 100, use higher numbers.

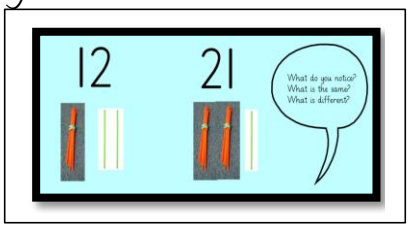
What does a fluent Year One child look like?	What skills do they have?
Place Value – They can; • Talk about and compare numbers to 100 • Order numbers using the language of reasoning • Use the language of biggest/smallest/more than/less than • Give reasons for their answers • Use a range of resources to represent numbers • Confidently use symbols, language, actions, model and images • Link their learning of place value and apply in problem solving across the curriculum	They can; • Count, read and write numbers • Count forwards and backwards • Count on/back • Use the language of reasoning • Independently use resources images, models, jottings • Link their learning • Solve problem in different contexts using number
How will I know I have been successful? • Children understand and can use mathematical language • Children can apply place value knowledge and understanding • Children can solve problems using place value and make sense of numbers • Children feel more successful in their learning • I can adjust the pitch of my lessons as the children become more confident	

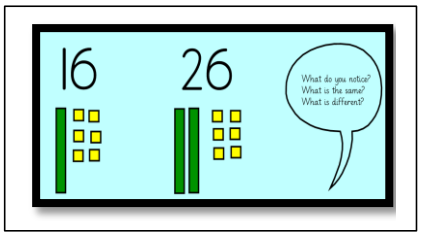
MathsHUBS Enigma

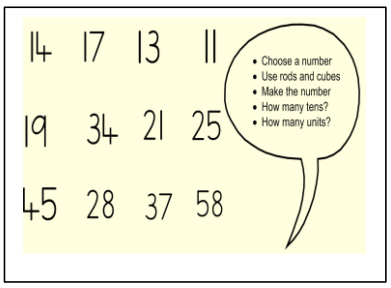
The project

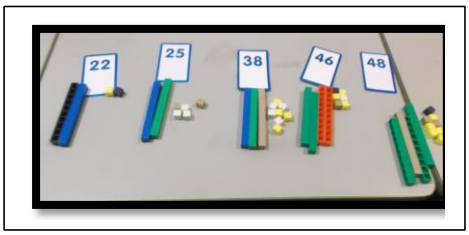
The extra maths sessions focused on building children's understanding of place value using the SLAM approach. Over a ten week period, the learning activities built up children's understanding of numbers to 100 using models and images, hands on resources, language and symbols.

Children learnt about numbers using straw bundles and base ten equipment. They were taught to talk about numbers, compare their sizes and use the correct vocabulary. They then applied this to games and activities focusing on two-digit numbers. In these games the children ordered numbers, identified the largest or smallest numbers and gave reasons for their answers.

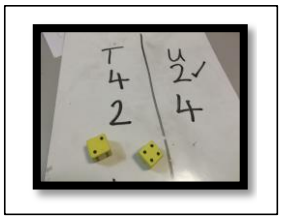


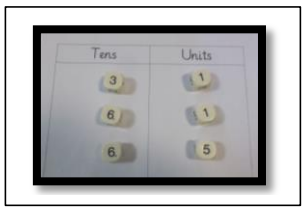


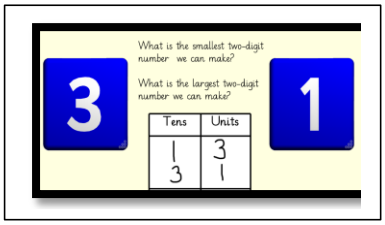


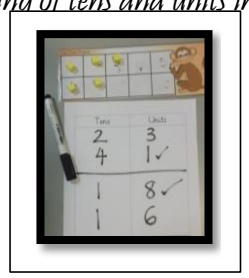


The next stage involved children using their understanding of place value, then linking and applying this when playing games using different equipment. In these pictures the children used dice to generate numbers and identify who had the largest or smallest number. They then scored points using a tens frame, where they exchanged unit cubes for tens rods. This reinforced their learning of tens and units in different situations.









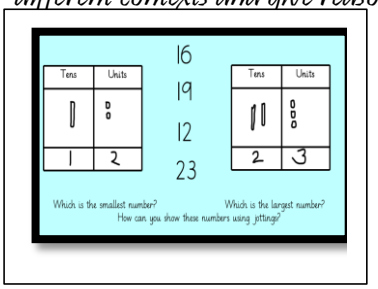
By this stage, teachers found that, as children became more confident, they were able to plan differently in the daily maths sessions. It was also noted that the lower achieving children were becoming more confident talking about numbers and were using the correct mathematical vocabulary when talking about tens and units. All children had the same experiences in the extra maths sessions and working in mixed ability pairs also supported the progression of all pupils. Higher achieving pupils supported others

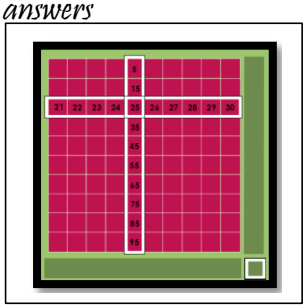
and developed their reasoning skills, whilst lower achieving pupils benefitted from higher expectations and peer support.

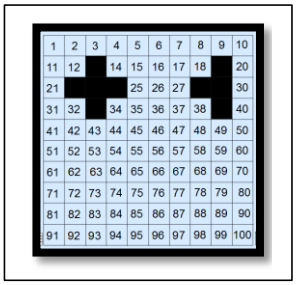
As we moved through the project, the children were also taught:

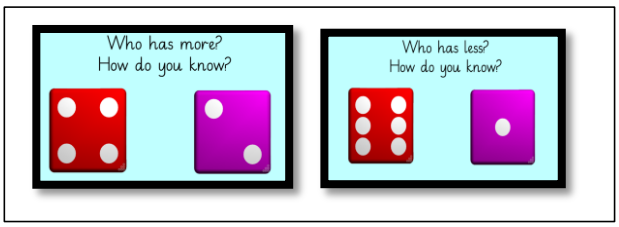
- How to make jottings to represent two-digit numbers,
- How to identify whether groups of objects had more or less and give their reasons why,
- To order numbers and explain their reasoning about how they know,
- To say one more and one less than any given two-digit number,
- To identify the missing numbers on a number square and give reasons for their answers.

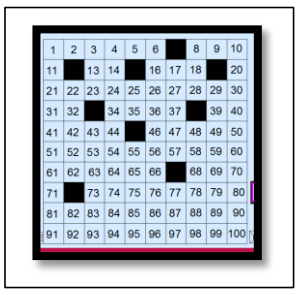
All of these were taught using the SLAM approach. First the children were taught the new skill using models and images, usually on the interactive whiteboard. Then, the children were able to have practical experiences using a range of resources in different contexts. Alongside this, the children were taught the correct mathematical language and symbols. This then enabled them to apply their knowledge in different contexts and give reasons for their answers











The staff training aimed to give teachers a clearer understanding of importance of fluency in number, reasoning skills and how using the SLAM approach benefits children when problem solving. This session was followed up by practical examples that the teachers could try with their classes. In addition to this, teachers were able to watch a group activity showing best practice in using the SLAM approach. Teachers were then asked to plan a group activity to be observed and feedback and coaching offered as a follow up. This would then lead into a discussion on how to move forward and fed into the next staff training, which has not yet taken place.

Outcomes of the project

With the introduction of the extra maths sessions in Year One, I found that the children were engaged and were focused on their learning. They were keen to apply their learning to different activities, games and problem solving. Working as a whole class, with all children having the same learning experiences, benefitted all groups of pupils. Children are using the correct vocabulary and most are able to give reasons for their answers. In maths lessons, teachers are able to plan differently so that more time is spend on the children's application of skill, rather than the teaching of place value and more children are confident making jottings to support their problem solving.

Teachers and teaching assistants have commented on how the lower achieving pupils feel very confident in the extra sessions and mixed ability pair work has enabled all pupils to succeed. The language development of the children is noticeable, especially children learning English as an additional language and adults use the language of reasoning more frequently when working with small groups.

In carrying out the staff training, I found that the staff were keen to look at their year group and discuss how to move forward with maths in the school. They are enthusiastic about the changes and feedback from the training was positive. However, the challenge as a subject leader is to then keep the momentum going and to regularly review the progress. I decided to offer the teachers a chance to observe best practice and have some coaching before the second staff meeting as a way of supporting them in the next stage of our school's mathematics development.

What difference has the project made to the pupils?

The child questionnaire was repeated and the results show that overall children feel more confident in maths lessons and would like to be further challenged. They have asked for more number games and to be taught lots of different number activities as well having access to number squares, cubes and base ten equipment.

Children's questionnaire – end of project after 10 school weeks.
When asked;

- 6/6 feel confident in maths lessons and when working with numbers (this result stayed the same).
- 6/6 feel confident working with numbers to 10 and 20 (this improved by 1 child).
- 5/6 feel confident working with numbers to 100, 1/6 felt okay (this was an improvement as none of the children now feel nervous).
- 6/6 feel confident talking about numbers (this improved as now all children feel confident)
- 4/6 feel confident when problem solving and 2/6 feel okay (this improved as now none of the children feel nervous).
- When asked what we could do to help, their replies were still varied – give us number squares, put rods and cubes out, play more number games, teach us lots of different activities to learn, use higher numbers, give us more maths challenges.

What difference has the project made to the school?

With 'Improving standards in Maths' being a priority on the school's improvement plan, I feel that the project has made a difference. Year One pupils will continue to have extra maths sessions and Year Two pupils will start soon. This will have an impact on attainment as pupils will feel more confident in maths. As the subject leader, I have a clearer view on how to support the school in moving forwards in maths. I am confident that by incorporating extra maths sessions into the timetable, focusing on fluency will make a difference to the outcomes of pupils. As a school we need to have a clear plan on how and when number fluency is being taught and that all adults in the school need the same training. I have discussed more coaching and observation opportunities as well as follow up training on teaching using the SLAM approach.

What have I learnt about myself?

I have gained confidence in my teaching of mathematics and as a subject leader. I have learnt that in order to lead a subject, I need to be able to work alongside colleagues and offer support and guidance when needed. I have learnt that it is not always easy to implement changes, but perseverance and the willingness to adapt helps. In my teaching role, I reflect on my practice more frequently and, when planning, I carefully consider the SLAM approach and how children can apply skills already learnt.

Other reflections

Undertaking a project like this has been very worthwhile, personally, for the school and pupils. This project would benefit other schools that are looking to improve standards in maths and who want to think differently about how to teach the new curriculum, in a way that fluency, reasoning and problem solving are a priority.

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