Evaluation of the Textbook Project, Year One (January – July 2015)

Introduction

The overall aim of the textbook project is to trial the use of Singapore style textbooks to support the development of primary mathematics teaching for mastery. The project commenced in Year 1 in January 2015. In the summer term the schools taking part in the project were asked to submit a report. The report below represents a synthesis of those reports.

Part 1 Summary

There are significant indications that the textbook project has had a positive impact on the teaching and learning of mathematics in Year 1 classes. The majority of the schools involved (92%) indicate that the project has achieved overall success. Positive outcomes include increased teacher subject knowledge (93%) and confidence (91%) in teaching mathematics. There has also been a positive impact on children's attitude to learning mathematics (91%) and on their attainment (90%). Teachers do however recognise that it is unrealistic to draw conclusions on the lasting impact of the rise in attainment and would want to look at sustainability over a longer period of time. However the teachers are confident that children have a more robust understanding of mathematics than previous cohorts of Year 1 pupils. Comments from teachers include:

> *Children have improved their knowledge of number, understanding the value of number, mathematical vocabulary and mental calculation strategies. More children now look for patterns to support their working or use known number facts to help them solve more complex problems.*

> *All of the pupils in the class have achieved the end of year expectations for Year 1. The four Year 2 pupils that were also in the class, who started the year at P levels, all achieved a level 2 at the end of the year.*

Children can do/understand concepts/strategies more thoroughly. Understanding is definitely deeper. Those previously thought to be higher attainers, had gaps in understanding, which have been addressed. Those previously thought to be struggling, have understood more than we expected. Children are now generalising and using known facts/previous learning more. Children's language is much better and they are able to explain using mathematical language – and question each other.

The teachers cite the use of representation, the development of mathematical reasoning, the use of mathematical language and speaking in full sentences, and the emphasis on studying concepts for longer and in greater depth as being the aspects that have had the most impact. Teachers particularly cite the positive impact this has had on what might have been considered to be the lowest attaining pupils.

There are still challenges to be overcome and areas for further development. The importance of the skill of the teacher in being able to challenge the higher attaining pupils still requires some development. Teachers are giving careful consideration to the ways they challenge these pupils, which include the use of questioning, challenging children to find more ways of solving problems and setting challenges within practice exercises.

The use of the textbook approaches in mixed aged range classes is a challenge for some schools and effective ways of working are being developed. Solutions that are being trialled include the teaching of children in age related groups, where one group is taught while the other engages in practice and consolidation activities. An alternative approach is for children to be split into age related groups and taught simultaneously with one group taught by the teacher and the other group(s) by a teaching assistant, with regular rotation.

Several of the schools indicated that they have seen the need to give careful consideration to the curriculum prior to Year 1. What are the concepts and skills children need to develop in the foundation stage so that they can engage with the year 1 curriculum successfully?

It is apparent that the training has been very significant with 90% of teachers rating it highly and many saying how it is essential if textbooks are going to be used effectively.

Some teachers identified that the use of textbooks did reduce workload (66%). Others agreed that although their workload was not reduced, the use of the textbook materials changed the focus of lesson preparation and provided more time for thinking about children's learning and this is seen as significant in accounting for impact.

Schools recognise that the use of textbooks is not a cheap option and whilst some are prepared to invest in both training and textbooks beyond the project many feel that the costs are prohibitive.

Same day interventions are considered to be both successful and essential. These prove to be a timetabling challenge for many schools, but there are imaginative solutions that match local need being put in place.

In conclusion to this summary section of the report are quotations from two of the teachers:

> *The big success in year 1 is the achievement of those children who have struggled with maths. If maths had been taught in the way we have done previously, then that cohort would have been progressing to year 2 with a wide range of attainment. As it is the gap is much narrower…… in the pupil interviews it was apparent…that they were more fluent, faster and their recall was much improved.*

> *Having seen the impact this project has had on my class I can't imagine teaching maths in any other way again! In particular pupil confidence in Maths, and their ability to talk about their methods using appropriate language, has improved far more than I ever thought was possible with Year 1 children before using these materials.*

Part 2 Quantitative Data

Percentages of teachers' responses to the questions designed to collect quantitative data from participating schools

The Textbook Project	has had a positive impact on my teaching	has developed my confidence in teaching mathematics	has been supportive to my planning for mathematics	has had a positive impact on children's engagement and attitudes to maths	has improved pupil attainment	has reduced my workload	has the potential to reduce my workload	has developed my subject knowledge	has been accompanied by high quality training which has supported my professional development
strongly disagree	0	0	0	2	2	16	7	0	0
disagree	7	9	2	7	7	28	19	7	10
agree	21	33	23	31	50	35	44	28	26
strongly agree	72	58	74	60	40	21	30	65	64

Percentages of maths leads' responses to the questions designed to collect quantitative data from participating schools

	has been successful	has improved the quality of teaching in mathematics in Y1	has improved teacher confidence in teaching mathematics in Y1	has had a positive impact on pupil attainment in Y1	has been supportive to planning	has had a positive impact on children's engagement and attitudes to maths in Y1	has reduced teacher workload	has the potential to reduce teacher workload	has developed teacher subject knowledge?	has been accompanied by high quality training which has supported teacher professional development?
strongly disagree	3	3	3	3	3	5	11	3	3	3
Disagree	5	11	5	11	0	0	22	13	3	6
Agree	24	39	24	30	32	24	51	47	18	17
strongly agree	68	47	68	57	66	71	16	37	76	75

Part 3 Full Report

Development of teaching

93% of teachers felt that working on the textbook project had a positive effect on their teaching. Many teachers comment positively on:

- the development of whole class teaching,
- the development of correct mathematics language and children speaking in full sentences
- the use of the Concrete, Pictorial, Abstract (CPA) model in ensuring that children are embedding concepts.

A teacher comments: *My maths lessons feel much more focussed and all the children are engaged and clear of the learning focus. They seem more able to remain on task now they are all doing the same thing – rather than 4 or 5 different activities in one lesson.*

There is evidence that teachers are making more effective use of manipulatives and visual images to support learning in mathematics. Particular resources mentioned are tens frames and the part whole model. Tens frames have supported recall of number bonds and strategies for addition and subtraction. The part whole model has supported children's understanding of the inverse relationship between addition and subtraction.

Many teachers talk about the structure of the lesson and the importance of studying something in depth. *I have changed the structure of my lessons to doing an anchor task followed by guided practice and then the independent task. Allowing the children to do the same number problem many times rather than doing many number problems one time*.

The change in teaching is making children have a different perspective on the mathematics' lesson. *They now understand that knowing the answer is not enough, they need to be able to explain how they know.* A significant comment sums up the feeling that working on the project has changed not only children's attitudes to teaching mathematics but also teachers. *I was never fond of maths and worried about planning my own lessons when I didn't think I had the knowledge myself. Now I love teaching maths and really enjoy using the textbooks.*

The subject leaders in schools are also very enthusiastic about the changes they have seen in maths teaching and the impact on children's learning. The following comments are indicative of the benefits of using the textbooks and the development that has resulted in the schools:

Making pupils explain every answer in a sentence and questioning their answers and the answers of their peers has greatly improved their ability to reason about mathematics. Several visitors to the school have remarked that the quality of the talk is so good that they could not believe that the children were only year 1.

The anchor tasks that start every lesson (exploratory problem) have successfully captured the interest of the pupils and has led to higher levels of engagement than during a traditional 'teacher input'.

The small steps and clear progression through the textbooks is very strong. Children are all confident and able to apply what they have learnt. The tiny steps ensure that all children have a good understanding.

The ping pong approach to teaching: "do together, do independently, do together" structure supports learning. The use of concrete, pictorial and abstract in the books and the use of manipulatives is a real strength. I have seen the strength in the Part Whole model and how quickly children pick it up and apply it.

Managing the class, everyone using the same manipulatives, doing the same activity has led to less work preparing the lessons, but greater knowledge of each child's learning and understanding.

The project has produced a radical shift in the teacher's understanding of classroom organisation in maths lessons, moving away from an ability grouping system to one in which, with the exception of children with high levels of SEN, all sit on an even plane. Therefore, differentiation and how the teacher defines it has changed and the teacher now finds ways to help the children access the lesson so that all can attempt the same activities. This approach has started to be implemented across the school and teachers have found that it is a key method that helps ensure sufficient children secure their year group objectives.

Furthermore, the method of securing good maths progress in Year 1 is now simplified so that children who have not secured sufficient progress receive same day intervention, regardless of the traditional ability groupings they would normally belong to.

The significance of teamwork is key to the success of the 'fix it' sessions in this project and without them; insufficient progress would have been made. It has resulted in staffing considerations for the next academic year and a look at a new pedagogical approach for maths.

The training had a rapid impact on the Year 1 teacher and she was able to deliver the project immediately after training.

In conclusion to this section, it would appear that overall the effectiveness of teaching has improved, supported by the textbook materials and a new form of pedagogy. Many of the teachers felt that the challenge for themselves has been developing effective questions that ensure they are engaging all the children. Some schools are starting to think about the requirements for children entering Year 1 to access the Year 1 curriculum and are reviewing the provision for mathematics in their Foundation Stage.

The challenges

Several schools mentioned the challenge of reading for some of the children and they have looked at strategies for overcoming this. One such strategy is to pair a capable reader with a less capable reader. In other cases some schools have felt the need to rewrite some of the material to address the reading difficulty in order to make the context accessible. Other teachers have used screenshots of the textbook pages pasted into a whiteboard and read out the questions with the whole class. An interesting comment made by a few teachers is that using the textbooks is improving children's progress in reading.

Finding time in the school day to carry out same day intervention has also been a challenge, although schools are looking to overcome this and again there are a range of strategies being used. These include reorganisation of the school timetable, working with targeted children during independent practice time and the use of additional adults. All schools have taken on the challenge of mixed attainment, but some still have concerns at either end of the spectrum. Low attaining pupils have been less of a long term worry with schools being surprised by how well these children have done and have realised that the textbooks have often dealt with access successfully. All are positive that mixed attainment teaching is essential. Some teachers have worried about meeting the needs of higher attaining pupils. They have also realised the need to explain the approach to parents who might expect their child to be moving on more quickly.

However, there have been some surprising results from this in that there are a group of children who I would have put into a lower ability group, have been able to access and understand concepts that I would not have introduced them to. By removing the 'ceiling' these children have been able to achieve above and beyond what I would have expected.

As mastery approach assumes keeping children on the same level and stretching the more able ones through effective questioning, it was initially difficult to keep the more 'natural' mathematicians engaged when they do independent work. I however have introduced a daily challenge they can complete after they have finished their work. This is usually either an open-ended problem or question (where children have to work systematically or find a pattern).

Some parents have also questioned why their children are doing such 'easy maths'. In response I have explained the principles of mastery, and most have been happy, particularly when they realise that their children do not have good metacognitive skills or struggle to apply their maths in a problem solving context.

Increases in attainment for children

Many of the teachers have identified that previously low and middle attaining pupils have made good progress over the six months that they have been involved in the textbook project, higher than would normally have been expected. This has resulted in most pupils achieving Year 1 National Curriculum expectations. There is less agreement on the impact on the project on previously high attaining pupils. These pupils would previously have been moved on to the context of the Year 2 curriculum. However teachers do talk about gaps in their knowledge being addressed and achieving greater depth of understanding.

All of the pupils in the class have achieved the end of year expectations for year 1. The 4 year 2 pupils that were also in the class, who started the year at P levels, all achieved a level 2 at the end of the year.

Communication is now excellent, I am so impressed with their confidence to explain their thinking and help their peers. Therefore, deepening their understanding and improving mastery. There is more independence due to a concrete approach. Number bonds knowledge has generally been greatly improved and mastered.

Those previously thought to be higher attainers, had gaps in understanding, which have been addressed. Those previously thought to be struggling, have understood more than we expected. Children are now generalising and using known facts/previous learning more. Children's language is much better and they are able to explain using mathematical language – and question each other.

The biggest positive has to be the planned small steps planning through the Year One Curriculum. One concept flows into the next and the children can see, and make, the links between each step e.g. inverse, working with bigger numbers. It seems to have given them more confidence in trying to work through new activities.

From the pre and post testing that schools were required to conduct the average percentage points gain was 24.8 percentage points with the median being 20 percentage points and the range was from 4 percentage points to 45 percentage points. It is difficult to read too much into this data. The main purpose of asking schools to conduct a pre-test and post- test was for them to be able to identify aspects in which the children had improved. The quotation below is an example that demonstrates this. However one school compared a parallel class not in the project with the class using the textbook. The text book class increased the average score from 33.5 to 52.4 whilst the parallel class moved from 35.8 to 44.8

Children were quite confident at the whole part diagram, I have never used this diagram before and it has helped their thinking. Their problem solving (interpreting word problems and recording as number sentences) was much stronger than past years. More children were able to understand an equation as a balance and also demonstrated a greater understanding of the concept of zero.. Some higher ability children got question 8 correct, this was very challenging and surprising. Children are much more confident at choosing appropriate resources to tackle problems.

Across the reports there is evidence that teachers attitudes to "ability" are changing. They have seen children achieve much more than previous Y1 cohorts of pupils and they have been particularly surprised at the attainment of children, they had previously viewed as "low ability". The language of low and high "ability" is difficult to shift, however attitudes to the terms are changing and some teachers are using the word *attainment* rather than *ability*. This reflects 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 and pedagogy, effort and a ‘can do’ attitude all children can achieve and enjoy mathematics.

Impact on pupil attitudes

Teachers (92%) report a very positive pupil attitude to mathematics. They, engaged, focused and enjoyed using the textbook materials. Only a couple of comments were less than fully enthusiastic about how positive children were.

My class have a renewed love for maths. The fact that they have a workbook has really excited them and the freedom of their journals has allowed them to become much less inhibited with their thinking. This has also spilled into my reception children and I now have a class of very enthusiastic learners on my hands

The children thoroughly enjoy their maths lessons. Of the 20 children in the class, 19 said it is their favourite lesson.

I love using the textbooks to help us with maths because we get to think loads more than before (pupil response)

The support provided by the textbook materials

The textbooks and support materials, including the teacher handbooks have supported both the preparation and teaching of lessons. Many teachers talk about how the materials have given them confidence in the sequence of learning in small steps. There are also many comments about how the materials are supporting both conceptual and procedural variation. Also there are positive comments about how the children enjoy the textbooks.

The textbook is sequential and so helps me to see the next steps that each child needs to take. I know that if they are having trouble with one lesson they cannot move onto the next. The textbook helps me to question and extend the children. The "Let's Learn" part breaks down the methods in a child friendly way and is easy for them to understand. I don't think I would be able to do it in such an easy to understand way every time if I did not have the books. The textbook and practice book allows me to spend less time deciding what to teach and to spend more time deciding how to explain and support the pupils.

The systematic variation in the textbook and work books helps the children to understand, for example, that ten is not always in a straight line, it can be in a circle and it can be in a spiral. The different pictures and formations that the children come into contact with frees up their thinking and stops them from becoming set in their ways. The different layers of the "In Focus" task, then "Guided Practice" and finally "Independent Work" gives the children lots of opportunities to practise methods and come into contact with different types of questions.

Workload

The teachers find the materials supportive. Some think that the support from the materials has reduced teacher workload, whilst others state that the workload has not reduced but the nature of that work has changed. They see that there is less time spent finding resources and more time thinking about the effective delivery of a lesson. Throughout the teacher reports comments have been made for the need to have electronic versions of the textbook and workbook pages to use with the whole class. Teachers need to create these, which is time consuming.

The textbook/workbook/online resource has reduced workload significantly. This 'extra' time can be spent 'unpicking' the lesson carefully. At last the teachers' focus is on the most important thing (the maths being taught) rather than trying to put together a cohesive learning experience for the children.

Whilst I still spend a lot of time on planning and preparing maths, this time is more focused on the children's learning and how I can provide depth and challenge for pupils in my class.

The value of the training

The teachers recognise that the training is essential and has been a significant element of the project. Most teachers have often found the training eye opening and inspiring. However some would have liked the training to be more focused on Year 1 and the use of the textbooks. Some teachers report that sometimes the mathematical content was insufficiently focused on the activities in the textbooks and how the lesson plans might be developed.

(The training is) essential! Without the training we could not have done it The training was imperative as it linked the books with the planning. No school could use the textbooks effectively without the online planning and the training. It is the changes in teaching approaches that is key and that doesn't happen through following a scheme set out in a book.

The training was exemplary. After about ten minutes of the training my enthusiasm for the subject had been renewed and I couldn't wait to get back into class again!

Some thoughts from interviewing children

Teachers reported that children have a deeper understanding of mathematics and are able to explain their answers more clearly. They notice the children's increased confidence and ability to tackle word problems. Children have demonstrated greater recall and when they cannot use recall are using their knowledge of number facts and sophisticated strategies to calculate. This is a move forward from just using counting strategies.

The following give two good examples of how teachers using the post testing interview questions are seeing children improve

Teacher 1 *Children were more resilient in solving the problems and didn't give up and say they didn't know an answer.*

Place value: the children could represent the numbers and explain what a specific part of the number represented.

Solving number sentences +/- : All children could apply a strategy to find the answer. There was greater evidence of instant recall of number facts, with quick responses.

Representing a number sentence: All children can do this now and were able to create a pictorial representation of the number sentence. When this was first encountered, they didn't understand what to do.

All children were able to answer this question efficiently. They recognised it as a number bond so if 9+6=15 therefore 15-9=6.

Selecting the correct cards to make a number sentence. All children were able to select the correct numbers. They knew where to start and quickly self-checked answers, rearranging to give the correct answer.

Teacher 2 *Children are able to discuss their learning and are really confident at explaining their ideas.*

Children are able to draw images to represent their ideas … they struggled to draw anything at the beginning.

They showed enthusiasm for some questions, eg the empty box type question, and answered these easily, whereas previously even at the end of y1 children found these difficult.

Children were able to suggest more than one way of doing things.

Some children were still using fingers, but most were more fluent with responses to questions such as: 5 + 8 … they said things like, 'I can see it in my head' or 'I know it' whereas last year children would have relied on counting on. They are now using their number bonds knowledge.

Children are clearer about what the digits actually mean, 'it's the tens, it's how many ones there are'.

Children were confident at saying numbers one more/less than numbers like 40 or 60 whereas they couldn't do this before.

Children are spotting patterns … eg: '2, 4, 6, 8 are even numbers' and 15 – 9 = 6 because 9 + 6 = 15 and 15 – 8 is 7

Questions such as: 5 + 5 + 5 = ? x ? would previously have been beyond Y1 children but some were getting this straight away and explaining what the = sign means, then linking the calculations. They were able to draw arrays and explain the links.

The following quotations give a flavour of children's thoughts

I am better at maths now because we have worked really hard in maths this year

My teacher has helped me because she explains how to solve problems.

Talking to my partner is fun and you get to do lots of it.

I am better at maths because I like to play with numbers

The part whole model has helped me. I used to be bad at splitting numbers but now I'm great

The maths lessons keep us really busy! We get to use lots of equipment to help us with our thinking.

Children's advice to a new teacher:

Listen to everyone's opinions and get lots of different ways to solve the same problem / listen to people who don't know the answer rather than just going on to someone else.

Do it like Mrs. Smith use the textbook to help you. Make it fun and interesting.

The impact of the project on wider school development

A high proportion of schools have used the project to start looking at the development of a mastery approach to teaching mathematics. The enthusiasm in year 1 and the difference seen in children have been a driving force.

Schools are considering the use of textbooks in other year groups. It is often felt that the best approach is to introduce them as children move through the school as textbooks would not meet the current needs of those pupils in years 5 and 6 as the range of attainment is broad and many pupils have not mastered the curriculum of the lower years and are therefore difficult to teach as a whole class.

Only one school has withdrawn from the project

Recommendations

The following are some recommendations, extracted from the report for future consideration:

- Textbook materials should be produced more cheaply in order to address the prohibitive costs that several schools have identified. This happens in other countries where books are produced using low cost printing and paper. Whilst the physical quality of the materials is reduced, the quality of the mathematics is not.

- All of the materials should be made available to teachers in an electronic format as well as paper format. This will support whole class teaching, particularly for younger children who are supported by a central focus and scaffolding from the teacher.
- High quality professional development should accompany the implementation of textbooks into a school