



LESSON STUDY RESEARCH REPORT

Building Maths strategy confidence through knowing, using and applying

Jo Constantinou, Alison Clark, Aleks Renzulio and Colin Dowland

Dollis Hill Junior School, London Borough of Barnet, United Kingdom

Abstract

Background: The study aimed to improve the ability and confidence of lower ability Year 3 Maths pupils in using calculation strategies, particularly number bonds to 10, through a multisensory approach. The effectiveness of different teaching strategies was examined, and the study allowed for experimentation and observation of individual student learning.

Aims: The aim of the study was to develop lower ability Year 3 Maths pupils' confidence and ability to use number bonds to 10 as a calculation strategy through practical resources and discussion. The study allowed for experimentation and observation of individual learning needs.

Methods: The participants are Year 3 pupils, including two case students (one EAL and one easily distracted), and three teachers (AC, JC, and AR/CD) conducting a lesson study to develop calculation strategies. The teachers shared responsibility, tried new ideas, and used Numicon more often. The lessons were a week apart, affecting continuity, but allowed for realistic understanding. The lesson study involved developing calculation strategies for a lower ability Year 3 Maths group using visual cues, rhymes, whole class teaching, partner work, guided group work, and Numicon.

Findings: The project highlighted the need for more practical resources and opportunities for students to explain their understanding. Planning and teaching difficulties arose due to scheduling, but the experience provided valuable insights into individual student learning needs.

Implications: The study found that practical and visual resources, such as Numicon, can support children's understanding of calculation strategies, but individual needs must be considered. The study also highlighted the need for training and dedicated planning time for teachers. The experience of observing one pupil closely during the lessons gave the teacher insight into how different children learn, but also highlighted the vast needs of every single child in the class.

Keywords: lesson study; mathematics; number bonds; Numicon; primary education

Context

Dollis Junior is a three form entry Junior School with currently 340 pupils on roll. Pupils are received largely from the feeder Dollis Infant School which is 3 form entry. Dollis Junior School is one of only two foundation primary schools within Barnet.

- The percentage of pupils who are entitled to free school meals (RO 2012 categorisation) is 51.9% compared to the National average of 26.2%
- The percentage of pupils from ethnic minority groups is very well above average 84.1% in 2012. National Average 2012 27.7%.
- The percentage of pupils whose first language is not believed to be English is well above average at 73.4% (R.O. 2012) National Average 17.5%.
- As of January 2013 there were 55 different languages represented in the school and a very wide range of different cultures.
- The percentage of SEN children on SA Plus and with SEN statements is above average at 12.8% (R.O. 2012) compared to the National Average of 7.9%.
- The rate of stability in the school is below average at 83.6% compared to the National Average of 85.4% (R.O. 2012)
- The school deprivation indicator puts Dollis at the high end of national average 0.33 (R.O. 2012) (0.24 Nat) and on the border to the top percentile rank.

The project wanted to examine the different strategies used by pupils when undertaking calculations. Since the school is 3 form entry, Maths is taught with two classes of middle and higher achievers and one supported class for low attaining pupils. A small intervention group also runs in Year 3. Pupil Progress Meetings take place termly to analyse the effectiveness of interventions and to inform the next wave of interventions.

Aims of the Lesson Study, Classes and Case Students

The lesson study was conducted in a Lower Ability Set Year 3 Maths Group. The focus was to develop the children's ability and confidence to build on prior knowledge of calculation strategies. The class teacher identified that some children were able to learn a strategy but would not always know how to use it to support them in other areas of Maths. Therefore we wanted to concentrate on a calculation strategy that the children should be confident with and be able to show how it can be used to support other calculation work.

Case Pupils

- **Case Pupil A** – CC - Y3 – 2c – girl. EAL pupil. She is not secure in her number bonds to 10 (focus calculation strategy) nor counting on mentally. She also finds it difficult to communicate her strategies particularly when problem solving.

- **Case Pupil B** – CR - Y3 – 2b/2c – boy. He shows confidence in his answers and is quick to pick out a pattern/ rule but can then easily make a mistake and not show a clear understanding- proceeding to call out random numbers. He is also easily distracted.

First research lesson (RL1)

- We wanted the students to add three numbers in a number sentence, identifying how number bonds to 10 (calculation strategy) could help them. We also wanted to provide the children with opportunities to discuss strategies when solving the problem.
- The lesson was planned to give the children visual cues to support them with their number bonds to 10 as well as a rhyme that they could learn and remember. We included whole class teaching, partner work and guided group work.
- The lesson was taught by AC. JC and AR were observing the learning of the case pupils.
- At the beginning of the case study, both children were slow to start and were reluctant to join in with quickfire questions of number bonds to 10, despite using the numbers bonds rhyme as support. CC shied away from answering questions during the warm up and CR only answered a question when asked by the teacher.
- When presented with three numbers in a number sentence, CC was confident at finding the number bonds to 10 to support her in working out the answer. When working out $5+5+4$, she was able to explain 'I know that $5 + 5$ is 10, and then I counted on 4 to get the answer'. CS was unsure what to do at first, and in his rush to work out the answers started adding the three numbers without looking for number bonds to 10 to support him, resulting in him getting fairly muddled. However he did start to get the hang of it. During the group work both children were confident with shared number sentences that were completed. When continuing with the work CC, who was able to identify the number bonds to 10, was constantly looking for support as to what to do next. With Teacher encouragement and asking CC to explain the task, she was happily able to do so and answer a number of questions correctly. CR was reluctant to use the strategy taught to support him in answering the questions, preferring instead to work out the answers by counting on his fingers.
- During the pupil interviews CC was able to explain what she had to do in the lesson, but with limited vocabulary (she didn't use 'number bonds or number sentences' even though this language was used regularly during the lesson). Initially, CC described the lesson as easy, but when questioned further about any difficulties she encountered she was unsure how she was going to relate her understanding to larger numbers. The only challenge CR was able to recall was 'the sentence with 9 in it'. He enjoyed the lesson and believes that he can now add 3 numbers more easily using the strategy. He was able to explain his method and said he will try to spot number bonds quickly now without counting on his fingers.

From the post lesson discussion we decided to work on using the number bonds to 10 to help them make a multiple of 10. We also wanted to ensure that the children were more engaged by asking more quickfire questions and introducing Numicon to use as a practical and kinaesthetic resource. We wanted to consolidate CC's understanding and move her on and we wanted to give CR a more kinaesthetic resource for him to use instead of relying on counting on his fingers all the time.

Second research lesson (RL2)

- We wanted the students use number bonds to 10 (calculation strategy) to help make numbers to 20 and other multiples of 10. We also wanted to provide the children with opportunities to discuss strategies when solving the problem.
- The lesson was planned to give the children a more kinaesthetic approach, using Numicon, to allow them to see how knowing the number bonds could support them in other work. We also hoped this would allow more opportunities for talk, with children being able to talk through their thinking process whilst using the Numicon. We included whole class teaching, partner work and guided group work.
- The lesson was taught by AC. JC and CD were observing the learning of the case pupils.
- Both children were thoroughly engaged in the start of the lesson, with CC being particularly keen to participate in the quick fire questioning that she had shied away from last week. CC was also able to explain how the number bonds could help her adding three numbers together. Both children responded differently when the Numicon was introduced. CC was able to join in quickly due to her confidence in using Numicon. She tackled her sums involving number bonds to 20 with ease; she seem to be able to identify which Numicon tile needed to be added with little thought. However, CR found it very difficult to use the Numicon. He was able to solve the questions and did so accurately using his fingers to count on. Initially I thought this was because he was unfamiliar with the Numicon equipment, but it became clear that he knew which number each shape represented. However, he continued to use his fingers despite being modelled with the shapes twice. He found it difficult to match the shapes with each other to form a ten (particularly $5 + 5$). He completed the first side of the sheet quickly and accurately but using his fingers to count on.
- The use of Numicon really supported CC's understanding of number bonds. In the pupil interviews CC did, however, find it very difficult to explain the aim of the lesson. I had to change my questioning to 'What were you being asked to do?' When she was able to describe the process she went through. CC said she felt comfortable with the task and was 'excited' that we would be using Numicon, because she had had experience of the material in Year 2. CR explained that he found it easier to count on using his fingers to count on. He felt that if this strategy worked for him, he would rather use this than use the Numicon, which he said was 'hard' to use.

In planning for the next lesson the decision was to persevere with the Numicon as it gave CC such confidence and we really wanted to veer CR towards trying a new strategy.

Third research lesson (RL3)

- In the final lesson we wanted the children to balance a number sentence, whereby the children would be able to show their understanding of the 'equals' sign.
- AC taught whilst JC and AR observed.
- Both children show a good knowledge of their number bonds and CR understood the concept of balancing the number sentences straight away. CC was very confident when using the Numicon; she clearly saw that she had to place the pieces on top of the others to work out the missing number. She was often first to use her Numicon to balance the sum when there was a single number on either side of the equals sign. CC was keen to offer her answers and

initially signalled to me that it was too easy. When asked to find the missing digit in a number sentence involving two addition sums she needed support. As predicted, CR was very reluctant to use the Numicon and needed to be supported throughout the task. He worked out the answers in his head quickly, but then got confused when placing the Numicon pieces on the table. Worked with support and was able to use the strategy by the end of the lesson. When asked, said he preferred to work the answers out in his head still.

- During the post lesson discussion we came up with an idea for another resource to reinforce the idea of time. To use a circle with moveable quarters and halves which could be moved to show time elapsed. We also decided that we should have included link to whole turn/half turn/quarter turn and made this practical.
- During the pupil interviews CR continued to show reluctance to using the Numicon when he could 'do it in his head'. Carmen enjoyed using the Numicon and was able to complete the task but she found it difficult to explain exactly what she was being asked to do in the lessons. When asked why her teacher had used balancing scales at the start of the lesson, she had some understanding of having to balance the sums.

What was learnt

- Models and images support pupils' thinking; balancing scales.
- Modelling using equipment (Numicon) support some children.
- A multisensory approach to number is supportive to children who are experiencing difficulties in early Maths skills.

Encourage children to try new strategies.

Impact on pupil learning and progress

During the three lesson studies it was obvious to see how each child has such differing needs – with CC flourishing when able to use the Numicon and seeing the link between calculations. However CR found the Numicon more of a hindrance and was determined to stick with his strategy no matter what. I would like to pursue more practical and visual strategies to give CR a range that he can work with. We found that when the children were able to talk through their strategies, they were far more likely to find links in other calculations.

In conclusion, pupils who are of a lower ability and not secure in their knowledge of a specific calculation strategy will find it very difficult to build on during future activities. Therefore it is essential to ensure those basics are taught.

Those that are secure in their knowledge of a specific calculation strategy (e.g. number bonds to 10) will be better able to use it to build on new calculation work, if they have practical resources available to them and can visually see and talk about the link.

Impact on practice and future teaching

- More work on the basics – ensure children's knowledge and understanding – can also be taught also during Reactive Maths (outside of Maths lesson)
- More practical resources available to all children , e.g. Numicon, number lines, cubes, etc. – also allowing children to choose what resources they want to use.
- Opportunities for all children to explain their understanding and strategies used.

- High expectations on correct use of vocabulary
- Planning for pace within lessons and challenges where appropriate

Impact on departmental and school approaches to teaching, learning and CPD

- Project highlighted the need for Numicon training to be rolled out to all staff
- Project highlighted how valuable it is to given dedicated directed time to planning, the observation and debriefings – impact on Leadership of Year 2 of the project.
- Project highlighted the fear, but ultimately the benefit of shared responsibility over planning a lesson
- Project highlighted that although children could be exposed to new strategies, they can be reluctant to try out new methods.
- Leadership team to try out Lesson Study Model on other areas of the curriculum

Personal reflections

I really enjoyed planning the lessons, with two other experienced teachers, particularly focussing on the needs of the individual children. Working so closely with others and sharing responsibility for the lessons allowed us to try out new ideas and see what happened without worrying about it. It opened my eyes massively to Numicon as a resource – and I use this far more often in class – with CR even beginning to use it!

One difficulty in planning and teaching was when we could be released to carry out the lessons. It resulted in them being a week apart – losing some of the continuity in them – but also allowing us to see how much the children may realistically understanding.

It was a brilliant experience to be able to observe one pupil so closely during the observation lessons. It gave me a real insight into how different children learn but also made me panic slightly – remembering how vast the needs of every single child in the class are!

I am looking forward to feeding back this experience to all the staff.

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