Effective modelling for early written mathematics

One of the problems is that the language used in official documents is not explicit about the difference between the terms ‘modelling’ and ‘examples’ and young children treat what the teacher has shown them as something that we expect them to use.

Easter egg cakes

In the nursery, the teacher had provided paper for the children to represent the number of (sweet) eggs they had each put on the chocolate ‘nest’ they had made. The children were hesitant and the teacher decided to draw her own bird’s nest cake on a large sheet of paper. She then counted four eggs on one of the cakes on the plate, and drew four ovals on her drawing of a nest. Following her example, every child in the group drew a nest as she had done, counted the eggs on their cake and drew some eggs on their drawing of a nest.

The children had all represented the number of eggs in exactly the same way in which the teacher had done. Clearly the teacher intended to support the children by providing an example of recording. However, the message that the children took from what they had seen the teacher do, was that this was the way they should represent the number of eggs on their cake. Alternative ways they might have chosen (dots, other marks, numerals or their own approximations of numerals) were not used.

Modelling within mathematical graphics

<table>
<thead>
<tr>
<th>Nikita, 3.4 years: indirect modelling - teacher introduced and provided birthday cards. Nikita chose to make a card for herself, whispering to the teacher, “I am three”.</th>
<th>Sam, 3.6 years: peer modelling – watching others play with calculators. Sam helped himself to paper and a pen and made his own marks</th>
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<tbody>
<tr>
<td><img src="image" alt="Nikita's drawing" /></td>
<td><img src="image" alt="Sam's drawing" /></td>
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Modelling for children’s ‘mental tool-boxes’

Like a real tool-box (full of spanners, chisels and screwdrivers to which new tools are added from time to time), if we provide a range of models throughout the week, children will have an expanding mental resource of symbols and written methods on which to draw - and which take them beyond what they can do now/

Modelling mathematics at the beginning of a lesson does not work because in effect, it has not become transferred to children’s ‘mental toolbox’ of symbolic tools.

Modelling that supports children’s mathematical graphics

| Family and community (socio-cultural) modelling | • Adults represent mathematics in real contexts  
| • Representations of symbols and mathematics in the environment and through media and technology |
| Peer modelling: focus on children’s own graphics as models | • Displays of children’s own mathematical graphics  
| • Discussing children’s mathematical graphics – focus on strengths, meanings, symbols, ways of representing, ideas and the mathematics |
| Indirect adult modelling | • Adults may sometimes participate in children’s play and represent mathematical thinking appropriate within that particular play context.  
| • Writing or displaying mathematical print and notices |
| Direct adult modelling | • Adult provides direct models (not copying) that offer new and alternative ways of representing mathematics, with either a small group or class |

Jessie, 4.3 years; Donna, 3.6 years & Daniel, 4.8 years: direct & peer modelling – jointly creating a giant number-line. Some children decided to make their own
Indirect adult modelling

An adult may decide to quietly join in when children are engaged in role-play, by following the children’s lead. Opportunities to represent some mathematical thinking on paper, and talk about what you are doing, include for example, writing a shopping list or a note for the milkman, or writing how many bottles of medicine the nurse needs to order. Displaying children’s mathematical marks and using mathematical print in the learning environments, indoors and out – is another way of indirectly modelling ‘written’ mathematics.

Direct modelling

To encourage children to think and to use their own ideas in mathematics, you will need to provide direct models outside of group sessions or maths lessons. This will allow children to add what you have shown them to their existing mental models, to help them make their own decisions and choices about the way in which they represent their thinking.

Direct modelling can take place several times during the week - ideally for a real purpose – and sometimes also for a real person.

It is best to avoid telling the children how they should represent their mathematics, but explore possible ways of representing their mathematical thinking (e.g., drawings, symbols, iconic representations, various forms of representing data) and written methods of mathematics – through modelling occasionally during the week.

| Carl, 4.5 years (nursery): indirect modelling – numbers in the nursery environment; adults talking about numbers. Carl decided to make some ‘parking tickets’ for his small world play of car-parks. | Amelie, 4. 4. years (Reception): indirect and peer modelling – numbers in the environment; peers using standard numbers and ‘+’ and ‘=’. Amelie was playing with two dice and put down what she had each time she rolled them (as dots). She also explored other ideas of symbols. |
Understanding the role and range of standard symbols and written maths

Models (as described here) allow children to gradually integrate standard symbols and ways of working with deep understanding of how and why. Over time children will move from their earliest marks, to use standard forms of written mathematics - around the age of eight years. Because children have different socio-cultural experiences, different levels of maturity, and different early experiences of drawing and mark-making, they will begin to use standard symbols at different ages (see overleaf).

**Alice, 5.3 years:** indirect modelling – *had watched the teacher doing the register*. Several children chose to make their own registers – Alice integrated the some standard symbols she knew and represented them in columns as her teacher did. In the centre of the paper she drew a packed lunch box.

**Children 5 – 6 years:** direct and peer modelling – *teacher had modelled icons, standard symbols and signs; individual children had invented use of arrows, hands and stars*. This group of children were playing a game with beans and flowerpots, to explore subtraction. This was the first time that any of them had represented subtraction and they chose a wide variety of ways to explore their thinking.