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WRITING IN PRIMARY MATHEMATICS – EXPLAIN 'WHY?'

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"Well, how did they get on?" Here is a typical enquiry between professionals. On this particular occasion, it came just after the 1998 round of National Curriculum Key Stage 2 Standard Assessment Tasks (SATs) for pupils aged 10 to 11 years in England and Wales. One teacher's response gave us much to ponder. *"Oh, I think they held their own. It was the written explanation in mathematics that they felt uneasy with."* Now, why should that be? What is difficult about written explanation? What thought do we give to helping pupils develop their skills in this aspect of the mathematics curriculum? These are the kinds of questions that we have been considering for some time with a group of teachers in Devon.

According to Reynolds (1998, para. 39) 'Good whole class teaching is an effective and efficient way of maximising the amount of interaction between the teacher and all the pupils'. No doubt during this interaction, many pupils are challenged to explain their reasoning verbally. However, we are concerned with children's written explanations because of the significant differences between verbal and written explanation. For example in a spoken explanation, the voice can be used to give emphasis to certain points or details. Alternatively, body language or gesture can be used leaving the listener to infer, and possibly voice the critical features of the explanation. The prompts that are available to children in conversation or discussion with the teacher are not normally available in writing. It is important, therefore, to consider the opportunities pupils are given to experiment with this specific form of writing. What, in fact, are we expecting of 11 year-old children in their explanations?

The guidance for marking children's responses to the SATs questions, may give us some idea of the 'official' view for this kind of question. We look to the Qualifications and Curriculum Authority (QCA) mark schemes. In their 1998 booklet for mathematics, the advice to teachers is embedded in such phrases as: 'explanations which identify all the discrepancies…'; 'explanation which explains the 'Why?' of a situation…'; 'explanation which refers to the fact that…'; 'explanation which indicates that'; 'explanation which implies that…'. Of course, these terms relate closely to the Programme of Study Using and Applying Mathematics (DFE, 1995). In section 4d, it states that 'Pupils should be taught to explain their reasoning'.

Judging from the advice that is given in the QCA mark schemes, pupils are to deal with the 'Why?' of a situation. To do this, they need to observe and perceive patterns, describe these and justify any conclusions they make about mathematical phenomena. They need to practice challenging their thinking, be aware of the intuitive leaps that they make, look out for any circular arguments, review their guesses and confront any of the 'dead ends' that they encounter. Now, is this reading too much into the assessment criteria? We think not. However, when we looked at some of the every-day expectations of pupils' written mathematics, we found that what they often write is a direct response to imperatives such as: 'copy and complete', 'How many…?' 'How much…?', 'Find the missing number'. More often than not, children are simply practising skills and rehearsing facts. We are concerned to pursue alternative patterns of pedagogy which would expand the range of writing genres available to children and to explore the effect on developing children's reasoning skills. Consequently, we are enquiring into ways in which we can support our pupils as they progress in their ability to provide written explanations. Demonstrating a high level of ability to explain orally does not necessarily indicate a similar level when working on written explanations.

We use writing frames researched by Lewis and Wray (1998) based on their conjecture that children's early attempts at non-fiction writing might successfully be assisted by framing structures. These writing frames consist of skeleton outlines that help children use the generic structures and language features of recount, report, procedure, explanation, exposition and discussion. Writing frames provide teachers with a scaffolding strategy to support children in their writing development without an adult necessarily being along side them. This model can be represented as follows: teacher modelling – joint activity (developing a frame) – scaffolded activity (children working with the frame) - independent activity (eventually dispensing with the frame).

One of the teachers in our group wanted to help the children in her class (Year 5/6) to explain how they had arrived at a

particular result in their mathematics. Here is a frame that her class developed to help them with their work on mathematical investigations:

My task is….

I think that …..

One reason for thinking that …..

Another reason is …..

In addition to this ……

This is why I think that……

We have collected numerous examples of pupils' engagement with this particular genre of writing. These results are encouraging. They provide evidence of Key Stage 1 and 2 children working with logical connectives in their attempt to sustain an argument throughout their explanation. The following piece of writing from a year-3 class working on odd and even numbers shows the relationship that this pupil had made between multiples of 3, 6 and 9: *Another reason is…don't forget 9s* ***because if*** *it will go in 3s* ***then*** *it will go in 9s.* Similarly, while working on a task with 2-dimensional shape, a year-6 child wrote: *Another reason is* ***if*** *angle D was made into 90º, 90º – 55º = 35º.* ***Therefore****, angle Y is 180º – 35º which equals 145º.*

Now, these must be worth a mark each.

Glossary

Standard Assessment Tasks (SATs) Externally prescribed assessments which incorporate a variety of assessment methods. These complement teachers' own assessments.

Key Stage The periods in each pupil's education to which elements of the National Curriculum apply. There are four key stages, normally related to the age of the majority of pupils in a teaching group. They are: to 7; 7 -11; 11-14; 14 to end of compulsory education.

References:

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