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TEACHERS' PERCEPTIONS OF GOOD TASKS IN PRIMARY MATHEMATICS

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Key stage two teachers were asked to describe a 'good task' which they had carried out with their class or maths set and to consider what makes a good task. A common response was that practical work makes a good task, though few practical tasks were described. Mental work on the other hand, featured in many descriptions but not in lists of factors of a good task. Teachers had some difficulty in discussing mathematical processes.

Rationale The work described here is part of the first phase of the 'Framing Teaching of Mathematics' project being carried out at the Open University. The overall aim of this project is to design structures to assist teachers in becoming aware of the distinctions they make when designing or selecting mathematical tasks. The first phase of the project is designed to indicate which factors teachers attend to when considering mathematical tasks. As part of this, the section of the work reported here explores what teachers perceive to be a good task in mathematics.

Background The work described is based on interviews with 22 KS2 teachers carried out between November 1998 and January 1999. Thus they followed the publication of the Final Report of the Numeracy Task Force (DfEE 1998) and came at the time when the Framework for Teaching Mathematics was in draft form (National Numeracy Project 1998). Schools were also in the early stages of operating the Literacy Strategy.

The schools used were drawn from two different L.E.A.s, neither of which was involved in the National Numeracy Project. Five schools from varying catchment areas were involved at this stage.

Method The discussion of good tasks formed the first part of a longer interview. Teachers were interviewed individually and the interviews were tape recorded. Teachers were asked to think of, then talk about, a 'good task' which they had carried out recently with their class or maths set. They were then asked to identify the factors which they felt made this a good task and write each factor on a separate post-it. Next they were invited to add any factors which make a good task in mathematics generally, but may not have applied to the task they described and write

them on different coloured post-its. Finally they were asked to put the post-its in order of priority. They were stuck down in order , to form what became known as a tree.

Following the interviews, all the post-its were collected together and an attempt made to sort them. From the initial sorting it was possible to identify common responses and to consider what may be missing and what attention was paid to mathematical processes. The interview transcripts were also used to shed more light on what the words and phrases on the post-its might mean.

Findings

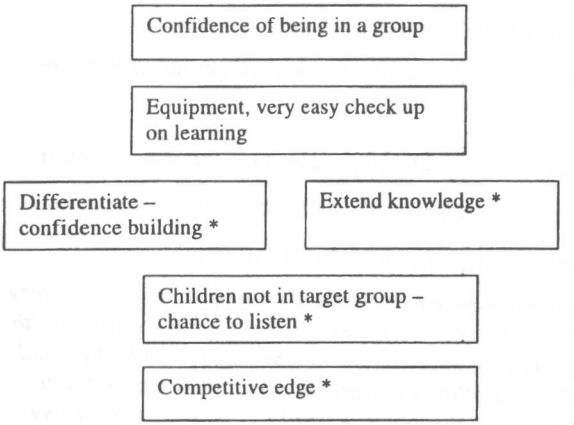
Initial Sorting - Common Responses The initial sorting revealed that the most frequently mentioned aspects were practical and enjoyment, the first of which is now considered. The category considered included all mentions of practical work or equipment. There were 14 such mentions, though only 5 of them were found to apply to the task described.

Of these five, three applied to data handling or measuring tasks. This left only two teachers describing a number task and listing practical as a good aspect of it . One of these tasks was a fractions task involving cutting and folding. The other was a decimals task in which children had to write numbers on the board, placing the digits in the correct column. The fact that the teacher considered this to be a practical task suggests she might be equating practical with physical. Evidence from elsewhere in the interviews supports the suggestion that teachers have a wide definition of practical work.

Angela is an example of a teacher who appeared to rate practical work highly. Asked to describe a 'good task' which she had carried out , she responded as follows:

Um, I think...when we've actually got equipment out, when we've done time. I do a lot of...sit them in a circle and work in a circle and, um obviously they all have their own individual things...equipment..mm. They do tend to respond more actually in a group ...we were doing, doubling numbers and um started off every lesson by getting...by splitting them into groups and then one group, you know, I just fired the same questions at them but they were in their groups and by the end of it they were all... they all knew doubles to twenty, so I thought that was quite good. I think they almost got the ...competitive edge... because they were in groups.

Following the description Angela recorded the factors she felt made this a good task on post-its. She used further post-its to write aspects of good tasks in general and finally arranged them in order of priority to form the 'tree' shown below. Aspects marked * are those she related to the task described.



Initial Sorting - Rare Responses Angela's example is interesting in that she describes a mental task but does not include 'mental' as an aspect of a good task. In fact 'mental' is a category which was surprisingly absent from the responses, given its current prominence in primary mathematics. No post-its were devoted to mental arithmetic or mental mathematics, though the word mental did get two mentions as part of a post -it . Despite the absence of mental as a category, many teachers described tasks which included some aspect of mental calculation. Discussion before and after the interviews suggest that all these schools are including mental arithmetic in their work.

One explanation may be that the teachers do not consider mental arithmetic to be a good thing . Another possibility is that they did not consider the tasks they described as mental, although many arguably were. Comments made by some teachers later in the interviews do suggest a narrow definition of mental arithmetic.

It is interesting to compare teachers' apparent attitudes to practical and mental work. The former is cited as a 'good thing' but seems to play a small part in lessons

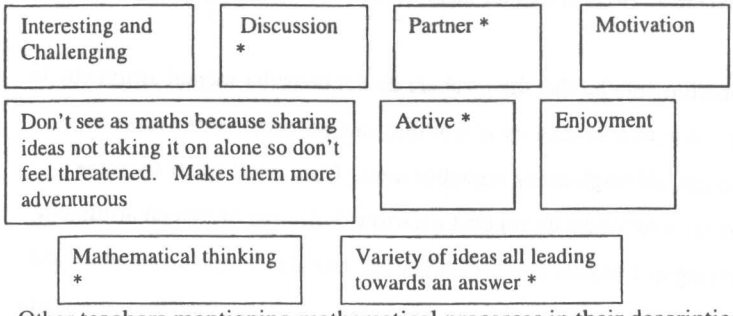
described, the latter is the other way round. There is a contrast also between the apparently wide definition of practical and the narrow definition of mental .

Mathematical Processes There were no clear references to mathematical processes such as proof or generalisation. One teacher wrote 'mathematical thinking' and there were mentions of 'challenge' and phrases such as 'makes them think'. Looking at the descriptions sheds some light on what teachers might mean by these words and phrases.

Of the 22 teachers interviewed ,5 talked about mathematical processes in their descriptions, though it was harder to see evidence of this when looking at the trees. An example of this is Mary whose description is repeated in full below.

Consecutive numbers, a string of consecutive numbers and finding ... they're not very good at explaining what they see and so they were asked... three-strings starting with an odd number and three-strings starting with an even number... and could they find a rule for the middle number? And until they were guided into, "Well how did you work that one out? Can you tell me what the next one will be?" by giving them any string. And then...we're homing in on it...but it's as if they've got... they can do as they're told but they can't think any further. Difficult actually taking them further and getting them to explain...saying, "Right now we need...", so that it will happen to any set of numbers so they can predict it. Very often they can predict it but they don't know why it works

Mary's completed tree is reproduced below. Her tree does not appear to match her description as closely as the previous example. The phrase 'Mathematical thinking' appears as a low priority. In putting it there Mary said ,"...comes quite a way down because that's what I'm building towards."



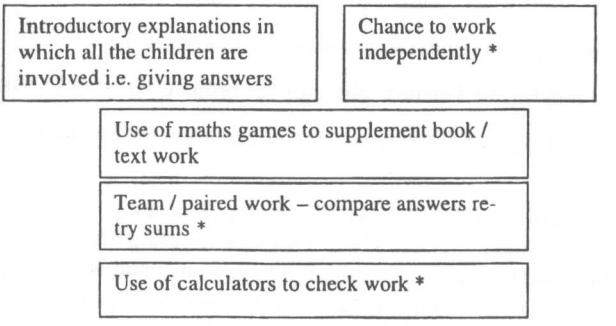
Other teachers mentioning mathematical processes in their descriptions showed the same tendency to give them less prominence in their trees. It is unclear why they

focussed less on mathematics as they wrote on the post-its. They may have been pushed away from these things by the questioning, perhaps feeling they were too specific and not what was wanted. It could be that the language to discuss these things did not come as readily as that used on the post-its which tended to represent an accepted discourse in mathematics education. It is also possible that they did feel those aspects which they chose to write on the post-its were more important than those mentioned in the description but later excluded.

There was another group of 3 teachers who described tasks and sessions where it seemed mathematical processes were important, but they did not make any reference to this. None of these were maths specialists and the tasks were either provided by the co-ordinator or found in a teachers' book. For example Steven chose to talk about a task which he had been impressed by which he found in a scheme teachers handbook. His actual description appears below with possible corrections in brackets.

Well we had an investigation on Monday which was creating...well you basically had numbers in order, for exanple 1 to 10 (1 to 9?) in order and you had a couple of numbers that were together. So for example 3 and 4 could be together and you had to fit in the plus or the minus. You had to actually create 100 in the end. So the total was 100 and you ... work out ... so for example 1+2- 3 + 46-5 (+45-6?) and you had to basically work out the sign to eventually create 100. That was ... they enjoyed that and they persevered as well.

Steven's completed tree follow:



It is interesting to consider what role Steven played in the lesson as all three phrases marked * talk about how the children might move on other than with the assistance of the teacher. Could it be that Steven was not in a position to help the

children with this task? Could it be also that he did not see the many mathematical possibilities arising from it? Although these points can only be speculation, a future aim of the project should be to consider ways of making teachers aware of the mathematics in tasks like this, or assisting them in being explicit about that awareness.

Summary One of the most frequently mentioned features of a 'good task' was that it should be practical, yet examples teachers gave of good number tasks were rarely practical In contrast 'mental' was never directly mentioned as an attribute of a good task, yet mental tasks were often described.

There were several teachers who talked about mathematical processes when describing tasks, but the features they described became diluted or replaced with others when they moved to summarising the task. Other teachers talked about tasks which appeared to have great mathematical potential, but gave no indication that they recognised this.

Further Questions One area for further consideration is the contrast between teachers' stated views and their apparent practice regarding types of activity such as practical and mental. One possibility is that teachers have changed their practice recently due to external pressures, but not yet changed their beliefs. This can be related to work considering teachers undergoing change and looking at whether changes in beliefs come before or after changes in practice (Franke et al 1997).

A second area for consideration concerns teachers' perception of the mathematics involved in doing tasks. The next phase of the project will seek to assist teachers in identifying and talking explicitly about the mathematics within tasks.

References

DfEE(1998)...*The Implementation of the National Numeracy Strategy*
Franke,M.L.,Fennema,E. and Carpenter,T.(1997)...'Teachers Creating Change: Examining Evolving Beliefs and Classroom Practice' in Fennema,E and Nelson,B.S., *Mathematics Teachers in Transition*, Lawrence Erlbaum Associates, New Jersey
National Numeracy Project(1998)...*Framework for Teaching Mathematics, Reception to Year 6*, National Centre for Literacy and Numeracy, Reading