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ABLE AND GIFTED: JUDGING BY APPEARANCES?

'I saw that one a minute ago and I was thinking how to do it'
Of course the question was supposed to be concealed under my carefully arranged notes. But Ben was more aware of what was going on than I was. Aware, alert, inspiring … and gifted.

The current climate is such that the needs of children like Ben are a major educational issue. The 'gifted and talented' strand of the Excellence in Cities initiative requires schools to identify a cohort of the top 5 to 10 per cent of their pupils. But what do such initiatives mean for mathematics education? The QCA web site 'Guidance on teaching gifted and talented pupils' (www.nc.uk.net/gt) contains a wealth of information, including guidance on the characteristics of pupils gifted in mathematics, some of which appear to be drawn from the findings of Krutetskii [1]. However, it is not clear whether such characteristics are largely exclusive to the gifted or shared by the much larger group of able children in our schools [2].

In this article I reflect upon an aspect of my research involving Year 6 pupils identified by their teachers as 'able' or 'gifted' in mathematics, using 'able' to refer to high achievers and 'gifted' to exceptionally high achievers. I discuss the differences I observed between the able and gifted when solving mathematical tasks, and consider what these differences may mean for professionals involved in identifying gifted pupils. I speculate that teachers' judgements are highly influenced by those aspects of achievement that are readily visible, such as answering questions quickly, and discuss the potential problems associated with judging by appearances.

The research

As part of my master's degree I carried out a small-scale study of pupils' approaches to a range of mathematical tasks. Here, I reflect upon the differences I observed between the able and gifted, illustrating my thoughts with pupils' responses to two tasks drawn from www.nrich.maths.org. The pupils were videotaped as they engaged with each of the tasks.

a and b are whole numbers. What could they be?
$a \div b = 4.125$

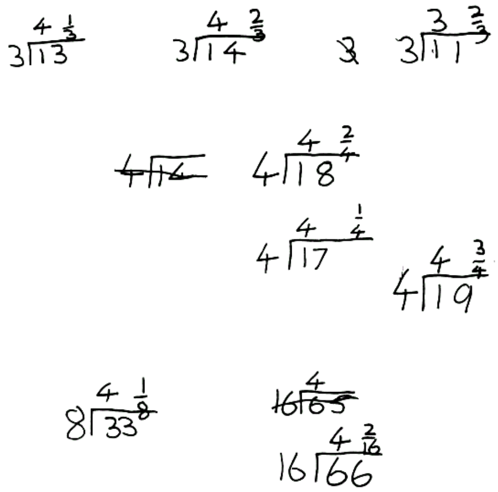
Unlike the question 228÷6, this task has no standard solution procedure; it involves 'problem solving' rather than 'knowing' [3]. Tasks such as this were valuable in revealing some subtle differences between the able and gifted. Essentially, the approach of the pupils identified as gifted could be described as strategic in nature …

'I'm just trying, like, to work out what would be near' (Tom, able)

Tom was identified by his teachers as able. Essentially his approach to the task was characterised by his attempts to find a quotient ‘near’ to 4.125 by guessing numbers for a and b below 20. However, in this case finding a ‘near’ quotient is not particularly helpful. He commented:

‘It’s just hard to know, because it’s a decimal’
‘I’m not sure how to work this out’

Although Tom recognised mathematical relationships in the problem, such as ‘125 is one eighth so I’ve got to get a remainder of one eighth’, he was unable to exploit this to help him solve the task, instead trying 9÷2, 7÷2 and 10÷3. Then he spent time working out possible quotients:



However, his lack of a strategy was a clear hindrance in solving the problem.

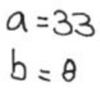
‘See how many times you have to do the 4.125 to make a whole number’ (Zoe, gifted)

In contrast Zoe, identified as gifted, took time to make sense of the problem from the outset, using her insight to plan a strategic response. She took control of the task, exploited connections and relationships, producing an elegant solution. After thinking for some time, Zoe recognised the relationship:

$$4.125 \times b = a$$

This enabled her to develop the strategy of multiplying 4.125 to make a whole number. But rather than trying numbers randomly, she exploited what she knew about decimals in order to obtain:

$$4.125 \times 2 = 8.25$$
$$8.25 \times 2 = 16.5$$
$$16.5 \times 2 = 33$$



She deduced a and b, explaining that b=8 ‘because it was multiplied by 2, then 2 again then 2 again’.

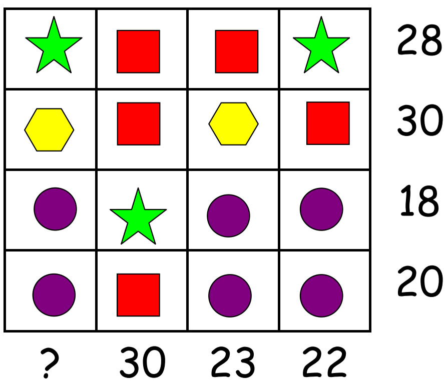
Sam and Ben, identified as gifted in different primary schools, also responded strategically to this task but identified 0.125 as one eighth directly:

‘You could times that by something. Like 4.125 times by 2. It has to be whole numbers. Times by 8 … That’s what one eighth is’ (Sam, gifted)

‘It would probably have to be 8 (.) because 8x1.25=1, 0.125 … ’ (Ben, gifted)

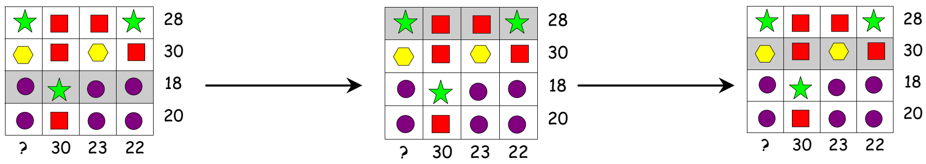
The insight of these pupils in exploiting connections resulted in elegant and concise solutions, unlike Tom’s trial and improvement approach with no clear strategy. These examples exemplify the observed tendency of the gifted to plan a strategy that results in an efficient and elegant solution. Further, as the second task will illustrate, they appear to maintain control of the task and awareness of their strategy throughout.

Each symbol stands for a number. The total of the symbols is written at the end of each row and column. What is the missing total?



‘I think that’s a 9 and them two are 3, the purple ones’ (Tom, able)

Tom’s attention was directed at what can be described as a surface level. In order to solve the task, he focused on one line at a time and selected immediate values that appeared to work. He made no attempts to check his answers. The shading in the diagrams below indicates Tom’s focus of attention.



1. Guesses value of star and circle:

   'I think that's a 9 and them two are 3, the purple ones'

2. Uses to calculate value of square:

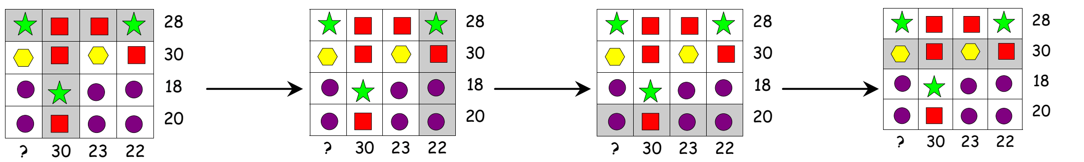
   'so that's 18 so they must be 5 to get the 28'

3. Uses to calculate value of hexagon:

   'that's 5 then 10 and then 10 and 10 makes 20'

'You can try and work it out on that row and see if it will work another way and then change it if it doesn't' (Zoe, gifted)

From the outset, Zoe took a more controlled and reflective approach. Her attention was initially focused on the whole grid and on planning a strategic response. She found the value of each symbol in turn, focusing her attention on selecting an appropriate column or row prior to finding the solution. Throughout the task she demonstrated awareness of the present focus in the context of the whole problem; her attention was directed in a logical and meaningful way.



1. Finds value of star and square
2. Finds value of circle
3. Checks value of circle
4. Finds value of hexagon

Drawing upon the pupils' responses to a range of tasks, it appears that the gifted are distinguished by their flair in solving conceptually demanding tasks. In addition to making sense of the task and planning an efficient and elegant strategy, the highest achievers maintain heightened awareness whilst solving the tasks, regulating their thinking and justifying their solutions for themselves. I now consider what these differences might mean for professionals involved in identifying gifted pupils.

Judging by appearances?

It seems to be that from a professional point of view, these differences are very important in the identification of the able and gifted. Linking directly to provision in its various guises, appropriate identification can conceivably maximise pupils' potential. I speculate that teachers' judgements are highly influenced by appearances. By that, I mean the features of classroom life that are most visible, apparent and immediate: the speed of response in the oral and mental starter; the accuracy of responses; the behaviour of pupils whilst working on mathematical tasks; their written work.

In practice, I think that some pupils are easier to identify than others. Some pupils seem to be relatively easy to identify. Having interviewed Dean, I realised that his distinctive mental ability, accompanied by strong non-verbal behaviour - moving his tongue round his mouth, running his fingers through his hair and screwing up his face, meant that teachers cold not fail to notice him in oral and mental activities. His lack of writing in mathematics, together with his strong sense of intuition meant that he was particularly noticeable. In this case, Dean's thought processes were strikingly similar to the strategic elements I have discussed, but for other pupils, I feel that judging by appearances can be more problematic.

We are in the age of the National Numeracy Strategy where one could be forgiven for mistaking 'pace' and 'rapid recall' as metaphors for competence. Speed of working and ability to calculate accurately are readily visible to teachers and may well unwittingly sway our judgements. Described by his teachers as highly intelligent but somewhat scatty, Sam would most certainly fit this description of the child with pace; he was bright, alert, articulate and fast. Yet Sam was unable to solve the symbols task for which his finely tuned procedures were not helpful: 'I can't think how to work it out'. Sam is unquestionably a high achiever, but I can't help but think that he would benefit from learning to take time to orient himself to the task and interpret the problem thoughtfully rather than rushing like a bull at a gate. Efficiency and elegance are important, and we need to show that we value them.

Finally, I consider Eve, identified as able rather than gifted, but successful in solving most of the tasks put before her, and comparable with the gifted in terms of achievement. It occurred to me that pupils such as Eve could easily go unnoticed in the classroom. A delightful child, quiet but very determined, Eve is a real 'thinker'. In many ways her use of visualisation and her characteristics contrast with Sam who is confident and more verbal. Maybe gender is also an issue here. Are boys the ones with the flair?

Implications

Having speculated that ability judgements may be largely based upon appearances, I consider what we can do about it in the reality of the classroom. It is my feeling that testing may not discriminate between the able and the gifted, or even identify them in the first place. Though high stakes, many tests fail to discriminate between the highest few percent because of the 'ceiling effect' [4]. Yet by observing and talking to children at work, the teacher is in a favourable position to gain an element of access to the children's mathematical processes, which may include the strategic aspects outlined here that may be associated with giftedness. Previous research also indicates that responses to mathematically difficult tasks are most effective at identifying mathematical giftedness [5].

To summarise:

- Ensure that the brightest children are given chances to show what they can do
- Show that strategies, elegance and efficiency are important as well as pace
- Testing is not enough; observe pupils over time, consider using audio and video recordings, displays of work
- Be aware of judging by appearances!

[1] Krutetskii, V. A. (1976) *The Psychology of Mathematical Abilities in Schoolchildren*, (Trans., J. Teller; Eds., J. Kilpatrick & I. Wirzup) Chicago, University of Chicago.

[2] Szabos, J. (1989) ‘Bright Learners and Gifted Learners’, *Challenge*, Issue 34.

[3] Span, P. & Overtoom-Corsmit, R. (1986) ‘Information Processing by Intellectually Gifted Pupils Solving Mathematical Problems’, *Educational Studies in Mathematics*, Vol. 17, pp. 273-295.

[4] Freeman, J. (1998) *Educating the Very Able: Current International Research*, London, The Stationery Office.

[5] Span, P. & Overtoom-Corsmit, R. (1986) ‘Information Processing by Intellectually Gifted Pupils Solving Mathematical Problems’, *Educational Studies in Mathematics*, Vol. 17, pp. 273-295.
Niederer, K. & Irwin, K. C. (2001) ‘Using Problem Solving to Identify Mathematically Gifted Students’, in M. van den Heuvel-Panhuizen (Ed.) *Proceedings of the 25th Conference of the International Group for the Psychology of Mathematics Education*, Utrecht, The Netherlands, Vol. 3, pp. 431-438.