Equals

for ages 3 to 18+

ISSN 1465-1254

Realising potential in mathematics for all

Vol.15 No.1

MATHEMATICAL ASSOCIATION

supporting mathematics in education

Equals

Realising potential in mathematics for all

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Published by the Mathematical Association, 259 London Road, Leicester LE2 3BE
Tel: 0116 221 0013 Fax: 0116 212 2835 (All publishing and subscription enquiries to be addressed here.)

Designed by Nicole Lane
Printed by GPS Ltd. Unit 9, Shakespeare Industrial Estate, Watford WD2 5HD

Editors' page

As usual the educational news is full of new government initiatives. Pupils are having their minds opened (what else have we been about all these years?) and teachers are going to become masters of education for a start. But whether any of this will improve the education of the children who are the concern of *Equals* - what we might call the non-A-to-Cs – remains to be seen. At least the opening up has been another recognition that a tight testing regime does not really provide a rounded education. This is perhaps most evident with 'the non-A-to-Cs'. What we should take particular note of though for this group is what a beneficial effect one-to-one tuition seems to have had on their learning. When I look back over my own years in the classroom I remember that when I was allocated a 'lower' set I would have to expect that any general statement I made to the whole class would be followed by as many individual questions as there were pupils in the class. The ability to apply a general comment to one's own particular situation is related to one's general abilities across the board. So, for those who are struggling, a comment which is directly related to their own situation and nothing else is the ideal. If there is an inclusive policy and the learning groups include pupils with a wide range of achievement levels then careful differentiation of amounts of teacher attention may be required. This may well be the chief reason for setting where it is practised but whether the extra convenience it apparently affords the teacher is worth the stigmatisation of those who are not in the top set needs questioning seriously. Even the politicians are beginning to recognise that all learning is personalised and, if the system is not organised to take this into account, the education provided will not be as effective as it should be for any learner regardless of their relative level of achievement.

Practical logic

Mundher Adhami considers how the study of mathematics can help children to order their world.

It is only right that practical activities like mending bikes, making tea, dish washing, packing a suitcase or disco dancing are not central to schooling. School is mainly for systematic knowledge that leads beyond what normal family and street life equip youngsters for. Some daily knowledge must be assumed to be acquired without paid professionals and technicians in maintained buildings.

OK, there are dysfunctional families and streets, and popular culture is often contaminated with trivia or harmful influence. So school has to compensate and give children fresh starts and chances. But even in doing so school should allow youngsters to look beyond what ordinary daily life offers. Practical activities then are mostly contexts for something beyond, rather than the aim of education itself.

Which school subject allows pupils to ***think*** about practical activities in the real world, to 'look beyond'? That is thinking about what they do, not just doing it. That is also linking that thinking to some systematic knowledge. Technology may be the nearest school subject to practical life, but it is often not seen as a central school subject and is also more concerned with materials and tools rather than the activities themselves.

Perhaps it should be mathematics. Perhaps thinking about the handling of objects and action in the real world is part of the Using and Applying strand! That is, after all the strand which addresses the development of logic, and was intended to be the link between all the school subjects. Much work is needed here, especially to expand the U&A strand beyond investigations in which numbers and shapes are the objects of attention, and into real life from which mathematics emerges or can be seen to be useful.

In 2008, colleagues working on the Bowland Mathematics[1] project produced excellent materials on practical activities which are mathematically rich. The final versions are now available to all schools. The quality of inset videos is really something to be celebrated. At the Institute of Mathematics Pedagogy[2] last summer participants had a chance to see the potential for creative mathematics in a group dance routine.

Many educationists would recall the creative period following the Cockroft Report (1981) which alerted the nation to the huge range of attainment at any one age and pressed for a balanced mix in the mathematics curriculum, including practical problems, real life situations and the use of natural language. Of the salient contributions in practical mathematics were the Mathematics for the Majority Project[3], and the 40 open-ended practical activities of the Graded Assessment in Mathematics Education project (GAIM)[4].

Perhaps it is time to look for these resources and resurrect them. It is also time for fresh experimentation by teachers themselves in practical mathematics. It does require that we enlarge our understanding of mathematics into its underlying logic. This is often related to the pre-mathematical stage in mathematising any situation. There is then the need for a language or vocabulary that directs attention to the progression in ordering things, classifying them, how space or time is organised, about causality, and how, for example, scheduling activities in a shop or a kitchen involve coordinating space, time, classes of objects, and ordering the carrying out of tasks.

The theme of this year's course in the CAME project in Islington[5] is 'Organising objects in space and time'' We are looking at how pupils handle everyday situations of space-object-time coordination, develop language to describe the process and outcomes, which may include mathematics, and for collaboration. The intention is to look for simplified practical situations which allow direct comparisons to be made to real life.

1. **Clearing a space,** e.g. how to make the largest floor space in a hall with various bulky and small objects. Perhaps using an A3 map with moveable pictures, to describe the best solution, including sizes, distances and practicalities.

2. **Tidying up for easy reach -** including grouping in sets, and a system for access with a clear description of use.

3. **Packing parcels** and other objects in a given space, e.g. a suitcase or car boot.

4. **Stepped process:** Arranging objects for an activity like washing up (input-output, sorting) or cooking, or mending a bike, or playing a game. This may lead to a flow-chart.

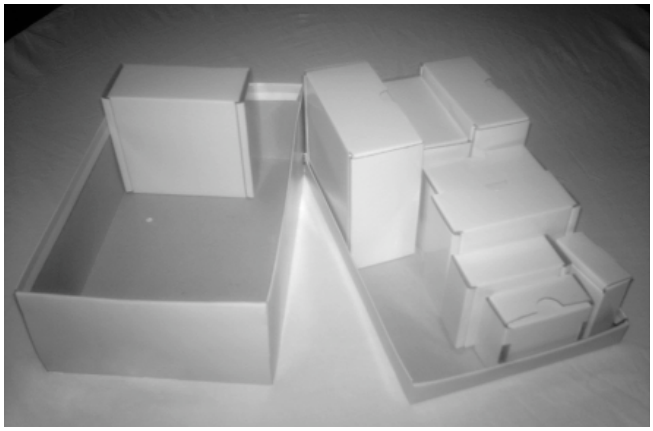
5. **Scheduling:**, e.g. as of tasks for a few people in a Garage or Fashion workshop over a couple of days (these are two GAIM activities).

In this field there is no substitute for activity trials and recording what happens. Teachers would benefit from trying to look at the logic, or the systematic ways the pupils work on an activity so as to recognise the progression in them. Then there is the possibility of linking these to the statements in the National Curriculum Using and Applying strand.

Arranging Packages is a practical activity that requires 5-10 small different size empty rectangular boxes, e.g. of medicines, cosmetics or food, and a shoe box that cannot take them all with the lid closed. The task becomes which boxes to pack and which to leave out. The activity can be presented as the same as that facing a shop sending items by post and the standard cheap box is the shoebox. What are the rules for packing? (For your pupils to try this activity see pages 12 and 13.)

The ideas are to move children from a haphazard first attempt, to a second trial following a conclusion from the first, to a third trial which follows a system. At each trial the pupils talk about what happens and which package is left out. For more able pupils this would lead to giving good reasons about the sizes and available space, about whether it is better to reduce the number of left-out packages or their size, possibly leading to measurement. The labelling of packages, ordering them by heights, widths and lengths, however defined, could be a step in the activity.

In the example here, the 9 packages in the Let's Think activity[6] cover almost all of the area of the lid but would not fit in the box with the lid properly on.



Even listing on the board what pupils say in words and phrases about sizes and gaps is a useful vocabulary exercise without the need for measurements. Some length, area and volume measurements will be considered but could be tedious for many. A more engaging line is making a list of rules of how practically to fill the shoe box e.g.: start from the largest box, then the next etc. The sophistication in thinking is dependent on how many features the pupil takes into consideration and how she or he coordinates them.

Use of the largest available lego-type blocks, seemingly suited for younger pupils, is intriguing. It allows the move to measurements in some near-standard units and for advanced work. The width, length and height of the pieces allow immediate measurements. The box itself would be easily measured in lego-units, and the gaps in estimates of halves or smaller parts. One further measurement which requires additional thinking is that the seemingly half-height units are only half height in the base while the protrusions are the same. It is like furniture, e.g. chairs, partly fitting each other so that two chairs are only one and half the height of one, as each chair adds only half of its height.

Often teachers have the chance to work with a small group of pupils. That is the best time for an hour's trial with one set of easily acquired materials at any age.

Cognitive Acceleration Associates

1. See http://www.bowlandmaths.org.uk/
2. IMP is a four day annual residential event organised by Anne Watson, John Mason and Malcolm Swan
3. Mathematics for the Majority Project materials edited by Peter Kaner was published in the 1970s placing mathematics in numerous real life contexts.
4. The GAIM project was directed by Margaret Brown and the creative mind behind many earlier activities was Dylan Wiliam. It is now out of print, and a new group at Kings College London is looking at reviving its use.
5. The Islington Zone CAME Extension and Development course comprises two slots of two-consecutive days per year. It includes trial in Islington classrooms and writing up of guidance for further trials. This year it is based at Ambler School in Blackstock Rd.
6. From the nfer-Nelson's Lets Think pack of 30 activities. By Philip Adey, Anne Robertson and Grady Venville (2001). This was originally intended for for Y1, but proved to be age-independent and usable across the KS2-3 for the special needs pupils, and with minor extension for most pupils.

Save the children

I can count further than I will probably live….
Kroo Bay, Sierra Leone, is the worst place in the world to be born.
In Kroo Bay 1 child in 4 won't make it to five.
Save the children leaflet, November 2008

Red Kites

The Royal Society for the Protection of Birds said that there were 1,200 breeding pairs across the UK, with numbers doubling in the north-east of England, rising by 40% in Yorkshire and at their highest for 200 years in Scotland.
Brighton & Hove Newsletter, April 2008

Lefties

Leonardo da Vinci, Michelangelo, Nye Bevan and Fred Astaire were all, like one in 10 of us, left-handed. Lefties appear to excel out of all proportion to their numbers. Of 44 US presidents, seven have been left handed. Barack Obama is about to be the eighth.
The Guardian, November 2008

Uneducated

There are still 75 million children without a school.
The Guardian, 23.09.08

The Numerate Dyslexic

John Hibbs describes from personal experience the difficulties dyslexia causes in the learning of mathematics - and in life more generally.

The phone rang.

'Hello, John? Alan here. I hope you don't mind but I've given your name to the Helen Arkell Dyslexia Centre. They want a talk on numeracy at secondary level. I said I thought you could to it. Will you? You will get a fee...'

So started a chain of events which has led me to change my mind about dyslexia and numeracy. The centre phoned me, I agreed, and prepared for an afternoon on numeracy with 25 teachers.

As a warm-up, I told them that I had absolutely no qualifications for talking to them. I had been head of a secondary 'sums' department, but I knew nothing about dyslexia, and little about numeracy. I was however dyslexic. I could feel their attitude change, and for the first time I felt I was amongst friends with whom I could confess I had problems with words and numbers. All my life I have been covering up the facts that I simply cannot spell, cannot take even simple messages over the phone, write and read numbers back to front, cannot remember my tables, and find mental arithmetic difficult.

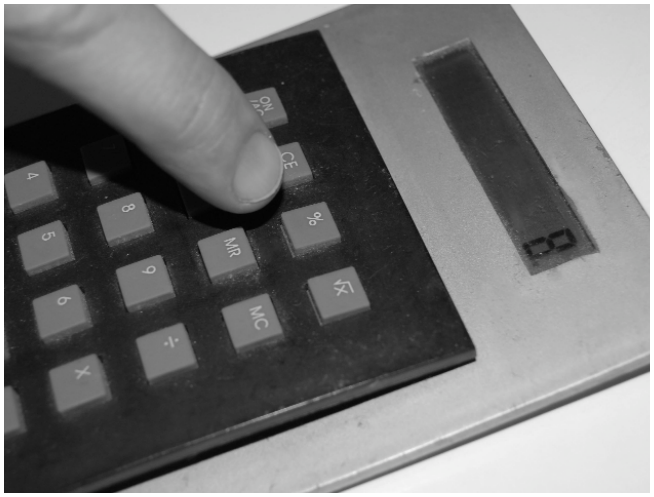
Friends, knowing that I taught mathematics, could not understand why I could not score at darts, had great difficulty with word games, and got embarrassed if they found any of my rough notes. All letters had to be written at least twice, and articles, papers and reports caused me great problems. At college, note-taking was almost impossible, as remembering - or trying to remember - how to spell a word got in the way of listening to the lecture.

What confidence a dictionary and a calculator would have given me at school. How much more creative might I have become if I had been taught to use a tape recorder? I was considered to be lazy. I was told to try harder. I was often accused of being deliberately uncooperative. Words were said to me slowly and with very careful pronunciation, but this was of no use to me, for I could not translate the sounds into word pictures. 'Dictee' froze my heart.

As a maths teacher, I could not understand why my colleagues required their pupils to be table perfect. I wasn't, and with a degree in mathematics, I could not see the problem. I constantly had to tell my pupils to listen to what I said, not read what I wrote on the board or vice versa. My classes must have heard me say a thousand times, 'You look after the arithmetic, I'll watch the maths'.

What then could we say about numeracy? A lot! The group and I set out to consider what makes me numerate in spite of my condition.

I can get on the 54 bus and can tell the difference between this and the 45. I can estimate, very roughly, how much money I need to take into a shop to cover what I need to buy. I can work out a route on the underground or on a map.



I know what a percentage is, even if I have to work it out from first principles and use a calculator.

We decided that the amount of survival maths we need is limited, but very important if one of our aims is to make students autonomous. The survival maths skills do not include doing sums on paper or being able to manipulate fractions, but could include being on friendly terms with a calculator.

I said that for my pupils I wished to move towards Michael Girling's now famous definition of numeracy:

'Basic numeracy is the ability to use a four function calculator sensibly' [*Mathematics Teaching 81*, December 1977]

and that 'if it cannot be done in the head, do it on the calculator' was the message I was now trying to get across to my colleagues.

What else have I internalized about numbers which makes me numerate?

I have an idea of conservation: the pile of six bricks does not become more or fewer if pushed. I have a feel for the sixness of six. I know that six is three more than three. I know that six can become 6 or 60 or 60000 just by position.

We told ourselves that 'little and often' was a possible key, and that confidence was ALL important.

We believe that these concepts should form our 'basics' without which formal sums become pointless.

What other principles did we come up with?

We thought that as long as there were children of seven in primary school demonstrating an ability with place value which some pupils of sixteen left school without, secondary numeracy had little meaning. We did however recognize the difficulty of developing activities to support low level number concepts for our more mature pupils.

An activity which is seen as childish is hardly likely to make an educational point. In this sense, secondary level numeracy is a real challenge requiring a careful match between pupils and activities.

We thought it important to try and encourage mental imagery of numbers within our pupils, and thought that a number line might be a useful model.

We reminded ourselves about the importance of working from a child's own method, however ineffective it might appear to us.

We told ourselves that 'little and often' was a possible key, and that confidence was ALL important.

We discussed how a calculator might be used as a mature teaching and learning aid towards basic number concepts.

And what did they tell me about my dyslexia?

They recognised my problem and they were quick to tell me that mine was only a mild condition, and that I was not to worry as, after all, Albert Einstein had been dyslexic! Perhaps I gained more from the afternoon than the group did. I left no longer feeling a freak with at least a couple of screws loose. I am now prepared to admit that I keep a tape recorder next to my phone to record people's names and addresses, and, most importantly, I now have the confidence to refuse firmly when asked to take minutes at meetings. This, plus my word processor with built in spellcheck, is freeing me from frustration and anxiety. Do other people have the same frustration and anxiety about numbers?

Waste

We throw away a third of our food in the UK, wasting 7 million tonnes a year. The majority of this is currently sent to landfill where it rots and produces gases like methane, a greenhouse gas 25 times more potent than carbon dioxide.

And more waste

Christmas 2007: our festive celebrations generated 3m tonnes of waste packaging, 750m empty glass bottles and 500m drink cans

Stonehenge

Charcoal fragments have been dated to 7,000BC, 4,000 years before the oldest stone circle … Organic remains secure dating of the bluestone circle to around 2,300 BC,
The Guardian 23.09.08

The Elephant and Castle Station of the Chatham and Dover Railway

Nearby is … Mr Spurgeon's tabernacle, capable of holding 5000 persons, which was built in 1860-1 at a cost of £31,000

Respect and responsibility in the classroom: *Part 2*

Jo Boaler continues to describe how a groupwork approach can enhance the progress of all in the group while simultaneously creating co-operative attitudes to learning and to life more generally.

(1) Reciprocity.

In previous research studies in England and the US I have interviewed many hundreds of students who have worked in groups. In virtually all cases students have reported that they prefer to work in groups than to work alone, but the students in all the other schools in which I have researched have listed benefits that were exclusively about their own learning. At Railside students also talked about the value groupwork added to their learning, but students' descriptions were distinctly reciprocal and they voiced a clear concern for the learning of their classmates. For example:

Int: do you prefer to work alone or in groups?

A: I think it'd be in groups, 'Cause I want, like people that doesn't know how to understand it I want to help them. And I want to, I want them to be good at it. And I want them to understand how to do the math that we do." (Amado, Railside, Y1)

The students at Railside did not only learn to help each other and to engage each other in work, they came to enjoy and value such practices.

The students at Railside did not only learn to help each other and to engage each other in work, they came to enjoy and value such practices.

It's good working in groups because everybody else in the group can learn with you, so if someone doesn't understand – like if I don't understand but the other person does understand they can explain it to me, or vice versa, and I think it's cool. (Ana & Latisha, Railside,Y3)

J: Like he was saying, I like the feeling of helping people and the feeling that you get when someone else knows something and picks up on a problem or an answer and then they're able to apply it and help themselves out. It kind of makes you feel like you're helping along the teacher. And I like that. (Jon, Railside, Y4)

Students learned to value the act of helping and to care about the learning of other students. In interviews students told us that they learned this from their mathematics classes and contrasted such classes with others at the school in which they worked in groups but did not learn to appreciate other students or want to help them.

Differences in the motivations of groups partly reflected the students' levels of interest in the work, which were higher at Railside, but they also reflected the careful ways the teachers at Railside taught students to work together. The Railside students came to view each other more respectfully partly because the teachers worked hard to create classrooms in which learning was seen as a collective rather than an individual endeavour. This involved teaching students to be responsible for each other's learning, something that would be perceived as controversial, or negative in some circles. Teachers encouraged this in different ways, including giving a constant message that students needed to work together as a group and that they needed to make sure all members of a group understood the work. They also reinforced the message by grading the discussions taking place in a group, and occasionally giving group tests in which students worked through a test together, but the teachers graded only one of the individual papers and that grade stood as the grade for all the students in the group. The students learned that mathematics at Railside was a collective phenomenon:

S: Math is really about group work 'cause you have like group tests and everything, so if you don't get it then you have to depend on your group a lot (Sue, Railside, Y4)

J:It's kind of the rest of your group's responsibility to make them understand. You know, you've got at most three people there to help you understand. (Jose, Railside, Y4)

An additional important way in which responsibility was encouraged was through a practice of asking one student in a group to answer a follow-up question after a group had worked on something. If the student could not answer the question the teacher would leave and come back. In the intervening time it was the group's responsibility to help the student learn the mathematics they needed to answer the question. The practice of asking one member of a group to give an answer and an explanation, without help from their group-mates, was a subtle practice that had major implications for the classroom environment – it meant that students always knew that they must take responsibility for others. In the following interview extract the students talk about this particular practice:

Int: Is learning math an individual or a social thing?

G: It's like both, because if you get it, then you have to explain it to everyone else. And then sometimes you just might have a group problem and we all have to get it. So I guess both.

B: I think both - because individually you have to know the stuff yourself so that you can help others in your group work and stuff like that. You have to know it so you can explain it to them. Because you never know which one of the four people she's going to pick. And it depends on that one person that she picks to get the right answer. (Gisella & Bianca, Railside, Y2)

The students in the extract above make the explicit link between teachers asking any group member to answer a question, and being responsible for their group members.

People often worry about the learning opportunities for high attainers who spend their time helping others. But our statistical analyses showed that the students who entered Railside at the highest levels attained more than the high attaining students at the other schools

They also communicate a particular social orientation that became instantiated through the mathematics approach, saying that the purpose in knowing individually is not to be better than others but so "you can help others in your group". At the end of the first year of our project we heard some resistance from the higher attaining students who complained about having to spend a lot of time explaining work to others but by the end of the second year they had changed their minds, as the following students explain. The two seniors (year 4) were asked whether they regarded the need to help others as a responsibility or a burden, they replied:

I think people look at it as a responsibility, I think it's something they've grown to do like since we've taken so many math classes. So maybe in ninth grade it's like Oh my God I don't feel like helping them, I just wanna get my work done, why do we have to take a group test? But once you get to AP Calc you're like Ooh I need a group test before I take a test. So like the more math you take and the more you learn you grow to appreciate, like Oh Thank God I'm in a group! (Imelda, Railside, Y4)

The students changed their minds partly because they appreciated the ways the act of explaining work deepened their own understanding and partly because their orientations had shifted from regarding their enterprise as individual and competitive to regarding their work as that of a collective. The sentiment expressed by the following boy also reflects the ways in which students learned to regard themselves as part of a collective working together:

J: Because when you kind of think about it, you're only as strong as the weakest…not really the 'weakest' but the person who doesn't really understand it the most. (Jon, Railside, Y4)

The actions of the teachers to change mathematics to a collective endeavour and to keep all students working together, even if some were able to move faster than others, is a contentious practice that many would regard as inappropriate.

In particular people often worry about the learning opportunities for high attainers who spend their time helping others. But our statistical analyses showed that the students who entered Railside at the highest levels attained more than the high attaining students at the other schools even though the other high attaining students went into tracked classes and worked with students of a more similar attainment level. Indeed the higher attaining students were probably the most well served by the Railside approach as analyses of the students' learning trajectories showed that their learning accelerated more than any other students.

(More extracts from "Promoting 'relational equity' and high mathematics achievement through an innovative mixed ability approach", which will appear in the *British Educational Research Journal*.)

See *Equals* 14.3 for earlier extracts

University of Sussex

Giants, Pixies and Elves learning decimals

Sarah Seleznyov shows how a made-up fairytale story served as an opening to the confusing topic of decimals.

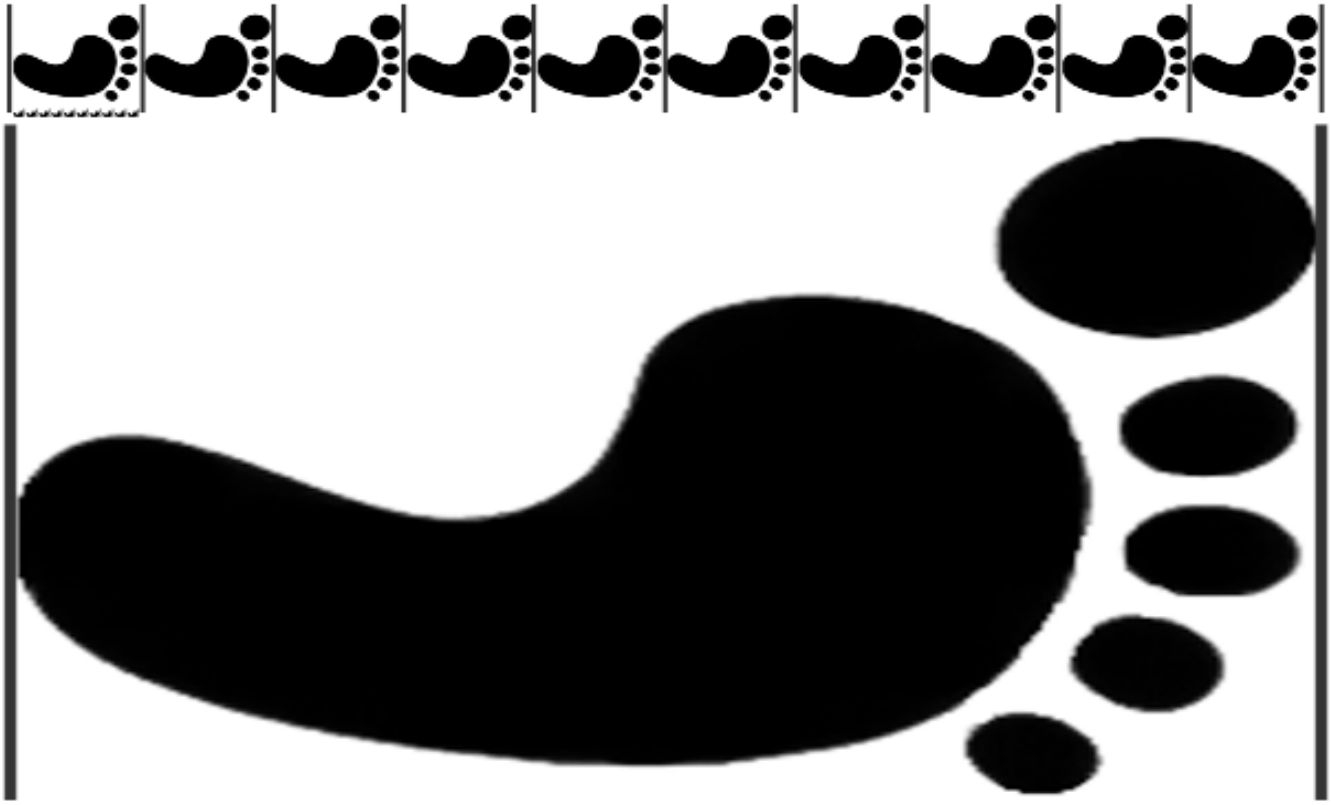
A group of educators creating and trailing new thinking lessons[1] looked into the common difficulties children have in mathematics across the key stages. We all agreed that fractions and decimals were difficult for children from Y4 onwards, and indeed, that many secondary pupils still struggled with the idea, for example, that 1.7 is bigger than 1.69. We agreed that this affected children's ability to measure accurately, read scales, and respond to real life problems involving measures and the use of graphs. The lesson described in this article was generated in response to teachers' thinking about the difficulties children face with certain mathematical concepts in starting in Year 4. Whether the context needs to be changed for older students is not clear yet.

As the discussion moved on to measures, I began to think of the story of the foot as a unit of measurement invented by King Henry I, whose foot was 12 inches long. I proposed the idea that using a giant's foot as a measurement tool might create a practical and 'real life' context in which children might be able to grasp the need for decimals. The group discussed how this might work and agreed that it seemed to be a workable idea. I then took the idea away and thought about how it might work as a lesson. The original idea turned into the lesson context, as detailed below:

There was once a giant who ruled a great kingdom of magical creatures like pixies, elves and fairies, many, many years ago, before measuring had even been invented. One night the Giant King had a dream about a beautiful palace and when he woke up, he decided he wanted to build himself a palace, exactly like it was in the dream. He wanted to tell his servants, the pixies, exactly how he wanted the palace to be built, but there were no such things as metres or centimetres, or rulers or tape measures in his kingdom. So what do you think he decided to do? Discuss and come up with the idea of using the Giant King's foot as a measure.

The Giant King's foot:

But what if some of the measurements in the palace were smaller than one of the Giant's feet – what could he do? Discuss and come up with the idea of splitting the Giant's foot into smaller units. Tell the children that he found out that 10 pixie steps fitted in one Giant King's foot.



I planned to develop the lesson by letting children use cut-outs of giant and pixie feet (see above) to measure objects, then to introduce the idea that some measurements were so tiny they required elf feet (100 in each giant foot). But ultimately, I wanted to see if they could tackle such problems as why 1.7 is bigger than 1.69.

I was fortunate enough to be observed in some detail by a researcher from the RECME project (Researching Effective CPD in Maths Education) when I trialled the lesson for the first time. I taught a group of around 20 Year 4 children who are all EAL learners, working in mixed ability groups for an hour.

The lesson began with a discussion around heights measured in feet, for example 5 foot 8 – what does it mean? This led to the idea of the need for standardisation: if Fatima says she is 4 foot 3, whose foot is she using? The class grasped the giant/pixie concept easily, and were happy measuring objects.

The lesson moved on to a discussion around the different forms of notation used. Some examples of these were:

- 5 giants 3 pixies
- 5 3
- 5 G 3 P

I complicated the children's thinking by telling them that in fairy land, nobody could write or read letters or words; they could only read numbers. The children began to suggest how the notation could distinguish numbers that represented giant's feet and numbers that represented pixie's feet. There were two suggestions:

- A large font for giant measurements, a small font for pixie measurements : e.g. **5** 3 , for 5 giant's and 3 pixie's feet.
- A decimal point in between the giant number and the pixie number, 5.3

I was surprised and pleased that the latter suggestion came from them. I had thought to introduce the idea myself, if no-one in the class suggested it themselves. The children were quite happy to convert their varied notations into decimals and to explain what these measurements meant in terms of giant and pixie feet.

Some children had been very accurate in their measurements and included halves, for example *8 whole one half pixies* and there were various alternatives to how this might look in decimal notation:

- 8. ½
- 0.8 ½

I saw this as a chance to introduce elf feet – 10 elf feet in every pixie foot. The children came up with the solution 0.85 for such a measurement.

I then came to the final story context for the lesson:

There was Gnome building a wonderful mosaic inside the Giant's Palace and the other Gnomes had to bring in the pieces for the mosaic in exactly the right order, from smallest to largest. But the pieces were wrapped in brown paper and all they could see was the labels on the outside – can you help them put them into the right order?

1.65	**16.5**	**1.7**	**1.05**	**1.9**	**0.99**	**1.75**

The children found this task very easy as groups. Those working at Level 2 in terms of the National Curriculum were supported by middle and high ability children if they became confused. They identified the giant number, the pixie number and the elf number and sorted the decimals within 10 minutes. This for me was a task, which if presented to a group children working at Level 5, would generate significant confusion and error. Yet here were children ranging from Level 3 to Level 4c tackling it with no confusion.

Even children working at National Curriculum Level 2, with the aid of more able peers, successfully handled a task which can confuse those children working at Level 5

So what was it that enabled this group of children to tackle this task successfully? For me, it was:

- The 'real life' context – although fairyland is obviously not *real* in the strictest sense of the word, for Year 4 children, it was a completely acceptable concrete and comprehensible context;
- The story – the children engaged with the story and were interested in it;
- The problem – children wanted to solve the problem, because they were immersed in the story and the context and wanted to help the citizens of fairyland;
- The concrete modelling – seeing the footsteps and using them to measure real objects set the mathematics in a concrete reality that enabled the children to eventually move into abstract thinking. (There were no pictures of elf feet!). The model was concrete and simple enough to support their thinking throughout the lesson.

And what enabled me to generate such a successful lesson? The group discussions around the principles of CAME learning meant I had a mental model of the above components of any successful CAME lesson. I also had the chance to bounce ideas off experienced colleagues, and I have subsequently been able to get feedback from them on how they experienced teaching the above lesson – in KS2 and KS3. The process of idea generation-discussion-trial-refinement-further trial-completion develops successful lessons that can have a significant impact on children's learning in the mathematics curriculum.

Sarah Seleznyov
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London E1 5RE

1. For the last two years, I have worked as part of a group of practitioners led by Mundher Adhami, Principal Researcher on the CAME project, to develop new lessons for the Cognitive Acceleration in Maths Education programme (www.caaweb.co.uk). This article details the process by which new lessons are generated and finalised by the group, and explains the success of one particular lesson in developing children's understanding of decimal notation.

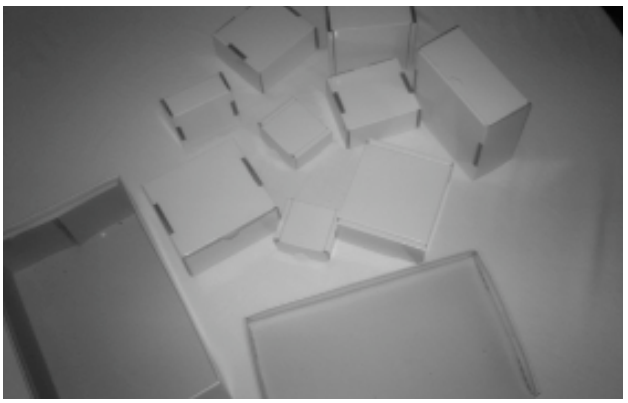
The group mainly respond to lesson ideas brought along by the researcher. These ideas aim to address gaps in knowledge and understanding of mathematics that are common among Year 4 children, but may be suitable for a wide range of ages. Generally, the group will read through the lesson idea, ask questions, discuss how it might operate in a Year 4 classroom, make amendments, prepare necessary resources and then trial the lesson with a group of Year 4 children. From observing how the children interact with the lesson, further changes are made. Each member of the group then trials each lesson with children in their own school, and discussions at subsequent sessions refine and improve the lesson further. The lesson is subsequently written up in a teacher-friendly format and the ultimate aim is to publish the lessons to complement existing KS1 and Year 5/6 CAME publications.

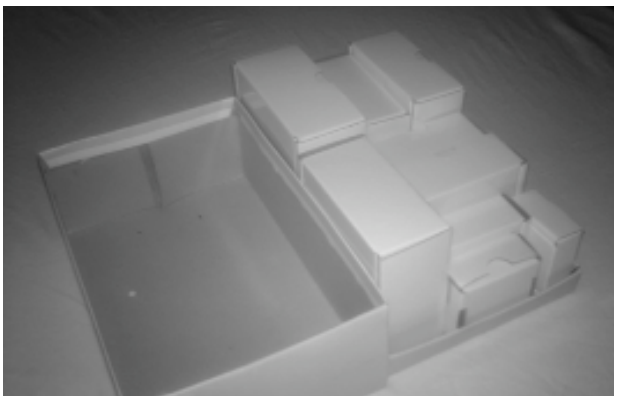
Packages in Boxes - 1

Imagine yourself working for a shop, sending packets of medicines or cosmetics or … in boxes by post.

There is a standard economical box, because a larger box is more than double the price. You have a number of packets that you have to fit into the box and you need to decide on a good method that works for different packets.

Here is one example of packets and box with lid. Yours may be similar in some ways.





The box must have the lid fully down when packed.

Work as a group of 3 (or 3 pairs) around a table. Give one answer from your group at the end.

1. Spread the packets and discuss for a couple of minutes what you notice about them. Think about how to order them or label them.
2. Decide who starts, then take turns. The first to go will also have another try at the end. The first, taking **very little thinking time**, places as many packets in the box without changing their position or taking them out of the box once placed. Stop when no more packets can go.
3. Take turns saying what improvements are needed so that more or bigger packets are placed in the box. Notice the packets left outside.
4. The second places packets in the same way. All should notice the improvement from the first trial, and suggest other ideas.
5. The third places packets as best as they can. All should notice the result of the trial and compare what is left out with the earlier trial.
6. Now back to the first to se if they can match or improve on the best result.
7. Jot down the advice you can give on the best way to place packets in the box.
8. Listen to other ideas and decide on your final advice.
9. What mathematics did you use in this activity?
10. How do you know the solution is the best one?

Packages in Boxes - 2

Imagine that these lego-pieces are miniature furniture which can be stacked on each other sometimes to take less space. They have to be placed in a large crate which must be secure. We want to find the best method.

Here is one example of furniture pieces. You have to pack them in a box with a lid. Yours may be similar in some ways.

Again work as a group of 3 (or 3 pairs) around a table and give one answer as a group at the end.

1. Spread the pieces and discuss for a couple of minutes what you notice about them. Think about how to order them or label them. See if they can all be fitted in the lid, or within some drawn boundaries to the same height or not.
2. Decide who starts, then take turns in placing pieces in the box. The first to go will also be the last to go at end of the activity. The first takes the **least thinking** method and places as many pieces in the box without changing their position or taking them out of the box. Stop when no more pieces can go in.
3. Take turns saying what improvements are needed so that more or bigger pieces can be placed in the box. Notice the pieces outside.
4. The second person places pieces in the same way. All should notice the improvement from the first trial, and suggest other ideas.
5. The third person places pieces as best they can. All should notice the result of the trial and compare what is left out with earlier trial.
6. Then back to the first pupil to see if they can match or improve on the best result.
7. Now jot down the advice you can give on the best way to place pieces in the box.
8. Listen to other ideas and decide on your final advice.
9. What mathematics did you use in this activity?
10. How do you know your solution is the best one?

One-to-one tuition

Jane Gabb reports on the latest strategy to improve pupils' attainment in mathematics.

In September 2008 Gordon Brown announced that 'any child who falls behind will not be left behind - but will now have a new guaranteed right to personal catch up tuition.'

What this means in practice is gradually becoming clearer. From January 2009 local authorities will have funding for year 5 and 6 pupils which will allow them to arrange for 10 hours of individual mathematics or English tuition from a qualified teacher. From April 2009 this will be extended to key stage 3 pupils, and in National Challenge schools, KS4 pupils.

This approach has been trialled in the 'Making Good Progress' (MGP) pilot schools and local authorities, and everyone who has been involved in the programme is very positive about its impact. There are difficulties in setting the system up, but there will be guidance from those pilots which will help local authorities and schools to learn from the early mistakes and pitfalls.

'The time goes really quickly because you are enjoying yourself.'

It is intended that the tuition is offered out of school hours, and mostly this will mean after school. Other models are also possible, including weekends and holidays, or before school. It is likely that schools will be asked to build up their own pool of tutors, some of whom may be existing teachers from the school. Other people are likely to be:

- retired teachers
- teachers on maternity leave or bringing up a family
- teachers from other schools

The class teacher will agree the curricular targets for a child receiving 1-1 tuition and it is very likely that the APP (Assessing Pupils' Progress) materials will be used for this purpose as they are very useful for finding where the gaps are.

The selection criteria for this intervention programme in the MGP pilots were:

- pupils who have entered a key stage below age-related expectations
- pupils who are falling behind during the later stages of a key stage
- looked after children who need this support
- 'harder to reach' pupils and those considered to have behavioural issues should not be excluded

Pupils have been overwhelmingly positive about the experience, saying:
'I felt special'
'There's just her and you, so you can have all her time, she can help you when you are stuck.'
'The time goes really quickly because you are enjoying yourself.'

Not surprisingly parents are extremely supportive of the offer and some have attended tuition sessions.

Teachers who have acted as tutors have found it to be very good CPD as they are able to intervene at the point of misconception and this has lead to more understanding of children's learning. It has sometimes made them rethink how they approach their whole class teaching of difficult-to-learn topics.

So, what are the pitfalls?

- Finding enough tutors, particularly for KS3 mathematics
- HR issues
- Where to hold the sessions
- When to hold the sessions

There is guidance coming out early in 2009 to help local authorities and schools to put this in place. There will also be guidance for tutors which will focus on pedagogy and include some video of good tutoring.

Royal Borough of Windsor and Maidenhead

Same label, different reactions

Ruth Smith, a teacher on the Graduate Teacher Programme in Windsor and Maidenhead, reflects on her experience of teaching 2 'lower-ability' key stage 4 classes in an all girls' comprehensive school.

Introduction

For my second school placement on my GTP course I was given two bottom sets in year 10 and a top year 8 group.

At this school each year is divided into two. Therefore there are two parallel sets for each level called X & Y. The top groups are called set 1 and bottom sets are labelled 4. I had both sets 4 in year 10, 10X4 and 10Y4.

The Profiles of the classes:

Before starting to teach these classes I picked up a profile of the pupils in each group from the teachers that ordinarily teach them and also further information from the SENCO department of the school.

a very big challenge at this level in making 'mathematics' interesting.

10X4: There were14 pupils in this class; their KS3 levels were 3s and 4s and their target grades for GCSE ranged from C to G. One pupil had moderate learning difficulties and another, Asperger's Syndrome.

10Y4: Of the 8 pupils in this class, only one had achieved level 5 at KS3 and the rest were at level 4. Their target grades at GCSE were mostly D or E, with 1 pupil targeted at grade C. One pupil in this class had speech and language difficulties.

In both of these classes there were pupils with behavioural issues that lowered their mathematical levels, (when these pupils applied themselves they were often very able) and pupils that worked hard and yet found mathematics difficult.

With all this information at the outset I thought that I would discover that:-

- *each class would be similar in terms of personalities and therefore the planning of lessons would be the same for both groups.*
- *setting the work at the right level would be relatively straightforward to plan due to the low levels.*
- *hands-on activities and interesting and varied presentations would be the keys to success with these classes.*

The topics I covered.

I taught two topics to these two groups. The first was *'Area and Perimeter'* and the second was *'Probability'*. For the purposes of this article I will focus on the 'area and perimeter' lessons, with just a few mentions of the probability lessons.

The activities I included for area and perimeter were:

1. The '**laminated**' lesson. (Designed by myself!)

   For this lesson I used laminated boards as floor areas and 'post it' notes that represented tiles. These 'post it' notes could be moved around and the aim was to find different ways of calculating area. This activity started by counting squares, then counting tiles around the edge of the laminated boards and from this deriving a more efficient way of calculating area. This activity eventually lead to their deduction of length x width for area. In a separate and subsequent activity I also used these laminated boards to experiment with area and to explore how the perimeter can change for a given area. Again with this activity this understanding of perimeter was deduced by the class.

2. 'Starter of the day' website which had some good activities that involved area and perimeters.

3. Worksheets to consolidate learning. I found 'Ten tics' a really useful resource because all the worksheets are graded according to the keystage levels.

10X4's (the larger class) responses

They responded well to the first of the '**laminated**' lessons. In fact this lesson was observed by their teacher and she felt that for the majority of the pupils they really got something out of lesson. I think as a group they responded well to a broad range of teaching styles and in particular this very kinaesthetic approach.

This class enjoyed computer based - 'starter of the day'- type puzzles. They worked well as an effective way of getting the class on task and focussed at the beginning of the lesson. They were sometimes quite boisterous at the beginning of the lessons and took quite a few minutes to settle. This was particularly apparent if the lesson happened to be the last one of the day.

when I got it right for the pupils they got it right too!

I found that they liked challenges that had specific answers; problems that involved finding the class's modal, median and mean answers did not seem to hold the same appeal.

10X4 responded to clear and brief explanations of each activity.

For part of the lesson, worksheets worked well and I found, during this time, I was able to give many pupils some individual attention. At these points in the lesson I was very aware that I needed to keep them motivated and on task and would often use lots of praise and encouragement. I found that when I set an expectation of how much work they needed to do before they could leave the lesson, this really focussed some of the pupils that needed more motivation.

For the plenaries and starters I would often use class discussion activities and the pupils participated well.

I never asked this group to work in pair or groups. This was because there were some deep seated hatreds between some of the pupils. This meant that I was unable to do some of the 'probability' type experiments with them. I did only have this class for 3 weeks and I feel that once I have more experience as a teacher I will have the confidence to try out different groupings and ideas with a class such as this!

In the 'probability' sessions I had access to past exam. papers and in one of the lessons I made reference to their forthcoming exams. The response was very negative and I was told by one pupil in no uncertain terms "who cares about exams anyway!" With the exception of one or two the reference to these forthcoming exams did not make any real impact. They said that they did not care about the exams at all and so as a result I did not use exam. papers very much.

10Y4's (the smaller group) responses

This class did not like the '**laminated**' lesson at all!

I was accused of treating them like children and they found this activity really childlike. In fact a significant majority took this activity as an insult (it was too babyish!).

I was completely shocked!

I very quickly came to the realisation that although a couple of the pupils in this class liked this activity the majority did not appreciate this practical approach.

I felt, after this lesson, that I had created a 'them' and 'me' barrier. I had to think long and hard about my approach to this class and get them with me rather than against me. I had to think about how I could 'engage' them. After a lot of thought, discussion and consideration I decided on an approach that, for a while at least, turned the situation around.

My approach came about in two distinct ways. They were:-

1. How I used mathematics vocabulary.

I decided to use all the appropriate vocabulary and not to simplify it in any way for them. I had been at times avoiding words and expressions that I thought too complicated for them.

During this period I met with a teacher from EMAS (Ethnic Minority Achievement Service). We went through how EAL students develop the English language and the person that I met explained the importance of vocabulary and cognitive language development. In fact, further reading on this made me aware just how much mathematics offers opportunities to develop cognitive language.

For example, with the topics of 'probability' and 'area and perimeter' pupils are able to:

- formulate questions
- predict results as well as interpret and explain findings.
- use verbs such as 'might' 'could' or 'couldn't' and 'must' to reason and predict through problem solving opportunities
- use the language of comparison: longer, longest, heavier than and positional language such as over, next to; on; to the left of; in the middle and so on when learning about shapes
- explain their strategies and reasoning by using logical connectives such as if…then..; therefore and because, and time connectives such as 'first'; 'next'; 'after that' and 'finally' to sequence their explanation.

I started to go for an approach where the class came to their own understanding of different terms rather than my avoiding the word completely if I felt they would not understand it.

So, for example, when I had to explain the word, "perpendicular", I decided to say it first, describe it, draw it on the board and then as a class we would discuss it and get an understanding of it. For this particular example I got a response of "Oh, so it is the same as right angles"

This approach seemed to really help.

2. Making reference to forthcoming examinations.

The pupils had mock examinations coming up in June and having looked at the questions in past papers I started to reference all the work we were doing to this. I would use statements like "We need to know how to do this!" and "These types of question frequently appear in your examinations papers!"

They responded well to this.

With this group when we started a new topic the response was always negative. As an example when I started on the topic of 'probability' the response was, 'Oh not again, we have done this loads of times!"

One of the difficulties that arises in a bottom set is that the topics get repeated frequently.

Orally and from a discussion basis it is easy to feel that the class or a significant majority of pupils understand the main points of many topics. However this dramatically changes when the pupils are asked to apply their knowledge with examples and mathematical activities. (This also applied to the top year 8 group that I was teaching during my second placement.)
Therefore it is easy for these pupils to feel that they have covered it many times but when it comes to the application they find that they still cannot do it. It is a challenge to keep it interesting for them when they feel they have done it many times before. Therefore I needed a point as to why I was covering it yet again for them and the forthcoming examinations gave me the ideal opportunity. I referenced all the work to the forthcoming exams and the pupils in this group liked it.

In fact this worked really well. This class liked working on 'past exam' papers. They took them home as homework and one pupil even asked me for more.

With this class I was able to work faster than with 10X4 and cover more ground. Even though they were set as parallel groups, the majority in 10Y4 were definitely quicker. A factor may have been that this was a smaller class and I was able to give more individual attention particularly when it came to applied work.

With this group I was able to put them into pairs for some of the activities. For example with the 'probability' topic I was able to get them to experiment with the tossing of a coin and forecasting the outcomes. With the other class this would have been unimaginable due to peer group issues and deep rooted hatreds!

Conclusion.

My findings were as follows:

There is never a set formula in planning and teaching any lessons. Each class is quite unique due to the make up of the individual pupils.

Therefore my lesson plans could not follow a set rule and I changed the way I delivered them for each class. As I progressed through the curriculum many adjustments were made for the different personalities within and between the classes. The objectives in the lesson plans were the same but the ways of achieving these objectives were different. For example when teaching 'probability' with one class I used a graphically designed activity from 'Mymaths' that demonstrated spinners, whereas with the other class I was able to use questions from past exam papers.

I was struck by at times how hard working, determined and motivated these pupils could be.

I feel there is a very big challenge at this level in making 'mathematics' interesting. The pupils appear to have poor retention, so it is always necessary to go back to the basics of each topic.

When a class discussion is initiated, many responses are given. From this the teacher can make assessments about their knowledge. However, this is not the whole picture and a thorough assessment of the pupils is obtained only when they try to apply their knowledge to different activities. So, although they seemed to have some understanding of both 'area and perimeter' and 'probability', I discovered that applying the maths they appeared to know was difficult for them and they needed assistance in remembering what to do and how to do it.

For 10X4 – I had to use a broad range of teaching styles, a variety of presentation and demonstration by examples as well as worksheets, exercises and examination papers. I set up the lessons with a lot of varied activities.

For 10Y4 – the fact that examinations were imminent proved to be the motivation that they needed. This group was more challenging and I had to work really hard to keep them with me rather than against me.

These lessons for both groups took a lot of thought and consideration– no lessons were easier to plan than any others. It is easy to assume, as I did, that because of the pupils' levels the lessons would be easier. In fact I think the converse is true. It seemed harder to keep them interested, motivated and on task.

As with any class, differentiated learning is important and I used 'Ten tics' as a resource that enabled me to differentiate the applied mathematics that I set for them. 'Ten tics' is levelled, starting at a lower level for each worksheet and then gradually becoming harder as the pupil progresses. For 10X4 in particular this enabled pupils to progress at their own pace.

I feel it is too easy to assume that low achievers always need practical and visual materials, (whereas 10X4 did respond to this approach). 10Y4 disproved this for me with the focus that was put into practising past exam papers, and their disapproval of my 'laminated' lesson. This has proved an important insight to me and reinforces the fact that you can ever assume anything.

I feel that as a teacher there is not a set rule for low achieving mathematics pupils. There are too many differences within any one class. I think flexibility is important and staying open minded at all times.

I was struck at times by how hard working, determined and motivated these pupils could be. I felt humbled and proud. I felt that when I got it right for the pupils they got it right too!

Windsor and Maidenhead

Greed?

We spent £84m shopping online on Christmas Day.
T*he Guardian* 29.12.07

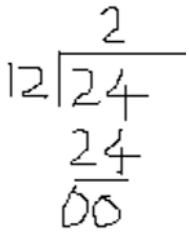
Snores cost their partners 2 years of sleep over a lifetime
The Guardian 29.12.07

Sorting out confusion?

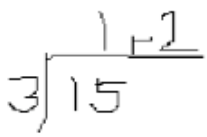
Martin Marsh recounts and reflects on an encounter with two Y6 pupils involving division. What can it tell us about teaching division?

I had the privilege of working with two Year 6 pupils last week. I had arrived about 45 minutes early for the lesson in which I was going to work with the teacher and asked if I could have two pupils to do some mathematics with. I was given James and Ayesha both of whom, I was told, were unlikely to obtain Level 4 on KS2 SATs. This was the dialogue.

MM: Do you like mathematics?
J: Sometimes
A: It's okay
MM: What do you like doing?
J: Adding and 'timesing'.
A: I like adding
MM: What would you like to be good at in mathematics that you find difficult?
J & A: Division
MM: O.K. Tell me something you know about division.
A: 24 divided by 12 equals 2
J: 5 divided by 3 equals 1 remainder 2
MM: Can you show me why and explain how you did that?
A:

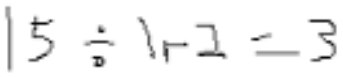


J.



Note: J. did say 5 divided by 3 and wrote 15 divided by 3

MM: [To both] Do these two answers look correct to you?
J & A: Yes.
MM: Is there any way you could check your answer?
J: I could use the inverse.
MM: O.K. Show me.
J.



MM: Are you both happy with this?
J & A: Yes.
MM: Let's try something different. Can you give me a word problem where 15 divided by 3 would be a useful calculation?
A: [After a bit of thinking]. If you have 15 sweets and you share them among 3 people how many do they get each.
MM: Good. So what is the answer to that problem?
J: 1 r 2
MM: Do you agree?
A: [*After some thinking gave a reluctant nod*]
MM: Let's say we have three people called James, Ayesha and Jenny. Each one will get 1 r 2 sweets.
MM: [I drew this picture]

James	Ayeesha	Jenny
1 r 2	1 r 2	1 r 2

MM: Is this what you are saying to me?
A & J: Yes.
MM: What is this remainder 2 they all get?
J: That's a half.
MM: So they get $1\frac{1}{2}$ sweets each?
J: Yes
A: No. They get 5 sweets each.
MM: [fake puzzlement]
A: 5 add 5 add 5 is 15 so they get 5 sweets each.
MM: That seems right doesn't it James?
J: Yes. I can never do division.
MM: What is 20 divided by 4 then?

J: 5

MM: 18 divided by 3

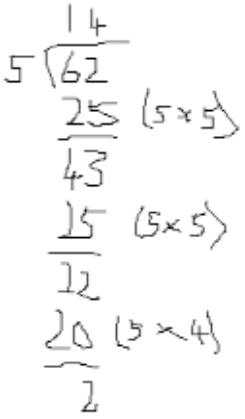
J: 6

MM: I thought you said you couldn't do division.

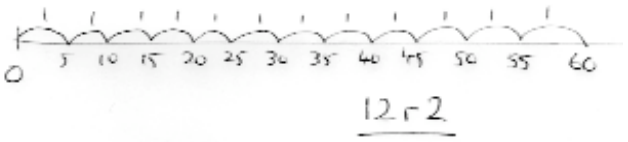
J: I can't to division like this [*Points to 'Bus Shelter' method for 15 divided by 3 above*]

MM: Let's try a harder one. 62 divided by 5.

J: I can do it by chunking!



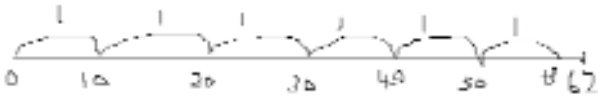
MM: Shall we look at this another way? Lets see how many groups of 5 we need to have to reach 52. [*I demonstrated this using the number line below.*]



12 r 2

MM: Could we have done this using fewer jumps?

J: Yes

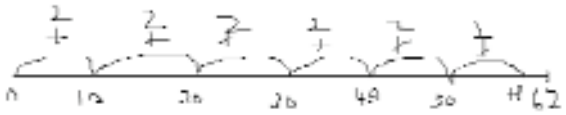


MM: What is the answer then?

J: 6 r 2.

MM: But I got 12 r 2. Who is right?

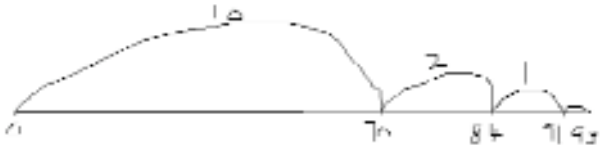
A: So we need to write 2 over the top and then the answer is the same.



J: 12 r 2

MM: Yes. Now try 93 divided by 7.

J&A: Both worked on it together and wrote this:



MM: What is the answer then?

J: 13 r 2

A: Yes 13 r 2

MM: Well done.

In the space of 45 minutes I probably hadn't changed the mathematical lives of these pupils significantly but they went away proud of their achievements, if the smiles were anything to go by. They promised to explain what they had done to their teacher.

I went away thinking about why after nearly 7 years of doing 1 hour of mathematics a day (about 1300-1400 lessons) two bright intelligent pupils were disinterested in the subject and had such a poor understanding of one of the basic operations of arithmetic.

Slough LA

Water

Water is the most common molecule on the surface of the earth. It covers 75% of the planet.
With a population of 6.6 billion people on the planet, fresh clean water is under pressure.

Leaking water from mains, industry and private housing accounts for up to a fifth of the UK's water.

The average person in the UK uses about 150 litres of water in a day in the home – but taking into account the water that goes into making products we consume, gets through a staggering 3,400 litres a day.

On average a shower takes 45 litres of water, a power shower 80 litres and a bath 90 litres.

'A dripping tap wastes up to 140 litres a week.
Ecover promotional materials

Addressing Gaps in Children's Mathematics – A Welsh Approach *Part 2*

Emma Coates completes her account of her work across the LEA of Rhondda-Cynon-Taf, South Wales.

Monitoring the project

I planned a cycle of monitoring over three terms that I shared with schools at the beginning of the year:

Autumn Term: Initial visit – discussions with the head, teacher and LSA to ensure resources were in place, the correct children were targeted and the project was given priority.

Spring Term: Observational visit – to observe Spotlight sessions and the LSAs supporting numeracy in the classroom.

Summer Term: Evaluation visits – discussions with the head teacher on the impact of the project.

Monitoring forms were created to keep and analyse as a record of my visits. Copies would be sent to schools as evidence, particularly for Quality Mark or inspections. This cycle of monitoring would enable me to gather the views of the LSAs as learners as well as the children. As my aim for the project was to improve 'children's' standards in numeracy and improve 'LSA' support for numeracy – I have 2 sets of learners.

Evaluation of results

Aim: "To raise the standard in numeracy of under-attaining pupils"

From baseline assessments from all schools we were measuring progress on:

- National curriculum letter increase
- Raw scores for addition and subtraction
- Attitudes to numeracy from 'Numeracy Interviews'

There was an average one sub-level increase for full support schools. This was a little disappointing at first but as we only covered addition and subtraction I needed to look at the isolated scores for addition and subtraction if I was to show the true impact of the project on this area of mathematics. These results were very pleasing with an average increase of 49% in raw scores in 2007 and 51% in 2008. When I looked at the range of percentage increases there were worrying extremes. There were 41 children who made no progress, on closer examination most of these had lots of gaps initially and were maybe too far behind to make a difference in an academic year. Just as worrying are the 35 children having over a 100% increase, with some individuals over 300%. These children's raw scores were very poor to start with so the percentage increase can look very dramatic. Are these our real successes? – After all, Dowker (2004) concluded that a small amount of intervention could make a big difference.

The most pleasing results came from analysing the numeracy interviews, focusing in particular at 'How do maths lessons make you feel?'

There was little difference between the results of boys and girls, supporting the findings of previous research.

The most pleasing results came from analysing the numeracy interviews, focusing in particular at 'How do maths lessons make you feel?' The responses initially were varied. Some were happy some were sad, but the majority were negative. However, by the end of the year the vast majority had responded positively, commenting on their ability now to 'have a go' in class.

There was little difference between the results of the 'full support' and 'training' schools. This showed that with a little extra support and training, schools could run an effective programme without a weekly visit of an LSA.

However, the 'Full support' schools were able to target more children with the additional staff.

Aim: "To raise the standard of LSA support for numeracy"

Evidence gathered from monitoring – strengths and weaknesses:
During the initial monitoring visits I was very pleased with the progress the majority of schools had made. All the full support schools and the majority of training schools had carried out their assessments and started on units of work. Schools who had not started were experiencing staffing difficulties and not a difficulty with 'Spotlight'. The children were enjoying the sessions and responding well to the one-to-one practical approach. A 'way forward' for the majority of schools was related to the collection of resources.

During the spring term monitoring visits the LSAs were carrying out the Spotlight sessions correctly and most were confident. LSAs that had been given time prior to the sessions to prepare and read through the material were the most confident, those who hadn't were over-whelmed by the amount of 'teaching' they were expected to carry out. The classroom observations were varied, although all schools were using the LSA to support numeracy if possible. Most schools were using the LSA to support small groups and LSAs were using a variety of resources and bringing to the sessions the skills and confidence they had gained delivering 'Spotlight' sessions. There was a minority of schools where the teacher would not allow the LSA to bring in extra resources or activities to the group they were supporting. These were the exception and the issues were raised with the head teacher in discussions.

The children's results were impressive, their attitudes to numeracy had changed, they were enjoying the sessions and teachers were seeing a difference in the classroom.

One of the biggest impacts of the assessment process and spotlight activities was to highlight the importance of 'mathematical vocabulary' – and lack of it in some schools.
We found many of the LSAs had the confidence to approach the numeracy coordinator with their concerns. Some LSAs had started giving class teachers lists of vocabulary from 'Spotlight' to use in whole class sessions.

During the summer term schools completed self-evaluation forms. The results were analysed and showed the project had had a substantial influence on developing the skills of the LSA. Schools reported:

- Increased confidence/self esteem
- Developed skill level
- Increased role of the LSA by having a defined responsibility
- Knowledge has increased dramatically
- Great job satisfaction
- Able to use her numeracy skills and knowledge within the classroom

Evidence gathered from training events:
I developed a 3 half day initial training package that proved to be the key to the success of the project. In the model the delegates are given a quick overview of the research behind the material, see it modelled on video, experience it in the training room then practice it back in school. This model allowed them time to carry out the assessments and Spotlights back in school and return to the training to discuss their experiences. Further training was offered each term and after each training event delegates were asked to complete evaluation forms. These were analysed and used to inform the content of the following training that I developed.

Conclusion – The way forward
The project to date has been very successful in meeting both the aim of 'Raising the standards of numeracy in under-attaining pupils' and 'Raising the standard of LSA support for numeracy'.

The children's results were impressive, their attitudes to numeracy had changed, they were enjoying the sessions and teachers were seeing a difference in the classroom. Many children 'graduated' early from the programme and LSAs found that one gap was filling another, making good use of 'Assessment for learning'.

The use of varied mathematical vocabulary was highlighted and many schools amended their schemes of work to raise its profile. Children with lots of 'gaps' initially, made little progress. These children were not our target group and need more than one session a week to make a difference. For the next academic year we will be tightening up our criteria to only allow children with less than 5 'gaps' to take part.

However, this was always going to be the 'easier' side of the project. The aim of 'Raising the standard of LSA support for numeracy' was far more complex and challenging.

We began with the barrier of LSAs own negative attitudes to numeracy. Looking at BSA data we should not have been surprised by this. Many of our school LSAs have no training to prepare them for supporting in our schools yet we expect more and more from them. Fortunately, with training and support, the majority of our LSAs are now more confident in their own ability as well as their ability to support numeracy. Evidence of this was gathered in evaluations from the 'Improve your basic skills in number' training early on in the project. By listening to their concerns I feel I have put together a training package that will both support and develop their skills. These skills in numeracy are already being transferred into the classroom.

Many schools raised concerns over the use of an LSA for half a day to deliver numeracy to a relatively small number of children. Hopefully they can now see the benefit that the half-day has had on those children and the LSA; and see that the LSA is now far more effective when supporting in their classroom.

With schools evolving out of the 19th century model on which they were established the project fits well in the governments ideas on schools of the future. In particular the deployment of staff more effectively and the changing perception of the value of support staff.

> *"As a greater variety of staff contribute successfully to learning, there will be changing perceptions of teaching and support provision'* (ESTYN, 2007)

It was a great achievement to receive the recognition from the Basic Skills Agency. We were included in the BSA supplement in the Western Mail on July 23rd 2007 (appendix 21). 'Spotlight' was showcased as a successful 'Key Programme' in Wales. This success has enabled us to secure future funding and embed the project firmly in all schools within the LEA.

The Dfes wave 3 material is difficult to grasp initially and any assumption that an LSA can just run with it without adequate training and support would be unbelievable to us here in Wales. It has definitely been an uphill battle to raise LSAs confidence and ablity to deliver the program even with our comprehensive programme of training and matched support. However, the Wave 3 material is such a wonderful resource that has made such a difference in our schools that we hope you can take away some of our ideas to make it work for you!

Rhondda-Cynon-Taf Educatsion Authority

On 6th August 1945 the USA dropped an atomic bomb on Hiroshima

The firestorm destroyed 13 square kilometres (5 square miles) of the city.
Over 60% of buildings in Hiroshima were completely destroyed and over 90% of structures were destroyed or damaged.
Up to 180,000 people were killed - out of a population of 350,000.

Three days later, on 9th August, a second atomic bomb was detonated over Nagasaki.

Nearly a quarter of Nagasaki's buildings were consumed by flames.
Up to 100,000 people were killed out of a population of 240,000.
In total around 250,000 people died in the first few days.

Today we live in a world where there are around 30,000 nuclear weapons.
These weapons are capable of destroying all life on earth many times over.
CND leaflet, April 2008

Everest

Hundreds of climbers flock to the world's tallest peak at 8,850 metres (29,035 ft) every year… an expedition in May collected 965 kg (2,100lb) of rubbish dumped by previous climbers
The Guardian, 17.11.08

Review by **Martin Marsh**

50 Mathematics Lessons – Rich and Engaging Ideas for Secondary Mathematics – Colin Foster (Continuum Books £18.99)

I must admit to a sense of *déjà vu* when this book arrived at my door. There have been so many books of this type over the years; books with lots of classroom ideas, lessons, worksheets etc. that I opened the book with little hope or expectation.

You may be surprised then, that having looked at the book in more detail for this review, that I am happy to recommend it to the readers of *Equals*. So what makes it stand out from other publications of this type?

Well, first of all the activities are very varied and very accessible to busy teachers without being patronising in terms of their mathematical content. They cover most areas of the national curriculum and provide engaging activitieswhich could easily be taught in one lesson or over a series of lessons. As the author states in his introduction, they are not 'spectacular one-off' lessons, but lessons, that should you so wish, you could teach 'eight in a day' and still have some energy left at the end.

The lessons are differentiated for the most able. Extension activities are built into all the lessons. There might have been more suggestions for simplifying or making some of the lessons more accessible to the type of children *Equals* is intended for but it would not take a huge amount of imagination by a teacher to do so. The starting points for the lessons are generally very accessible.

A final very useful feature is the link to a web site (www.50maths.com) which the author has set up to provide useful resources to supplement the activities in the book.

The book would make a very useful resource for teachers in a secondary school or possibly even the top end of Key Stage 2.

Slough LA

Is this test worth taking?

About 121,200 of the key stage 3 tests had to be re-marked. English Sats papers were sent back for remarking between 2005 and 2007… That's just over 6% of the 1,950,000 tests taken by pupils in England in that time. It has cost schools hundreds of pounds. They pay £5 to the National Assessment Agency for each exam script that is re-marked, with a maximum of £250 for a whole year group.
In 2007, 116 schools asked for all their year 9's English tests to be re-marked. That's 11.5% of the estimated 650,000 sat by pupils that May. Substantially fewer were re-marked in 2007 – 25,549 – despite roughly the same number of the tests being take more than the 20,544 sent back in 2005.
TES

Pesticide

A third of all food products tested had chemical traces.
Very small percentage posed risk, officials say.
Scientists found traces of pesticides in 70% of samples of free fruit and vegetables destined for schoolchildren, it was revealed yesterday …
Overall more than a third of food and drink products tested in the UK last year contained chemical traces and 1.7% - 60 samples of the 3,562 surveyed - had residues above the legally permitted limits. … In all 138 apples, bananas, carrots, cucumbers, pears, strawberries, tomatoes and soft citrus fruits such as
tangerines and satsumas were tested by the committee.
The Guardian, 11.09.07

Bingo

Nearly 4 million people in the UK, the majority of them older women, play bingo at least once a week. But last year 25 clubs out of 464 in England closed due to financial pressure. … Nearly 80% of over 70s have gone to the same club for more than 10 years.

Unrepresentative?

The2005 House of Commons is one-third privately educated against 7% in the wider population. There are 79 lawyers, while only eight MPs describe themselves as semi-skilled or unskilled workers.
The Guardian, 17.11.08