Equals

Realising potential in mathematics for all

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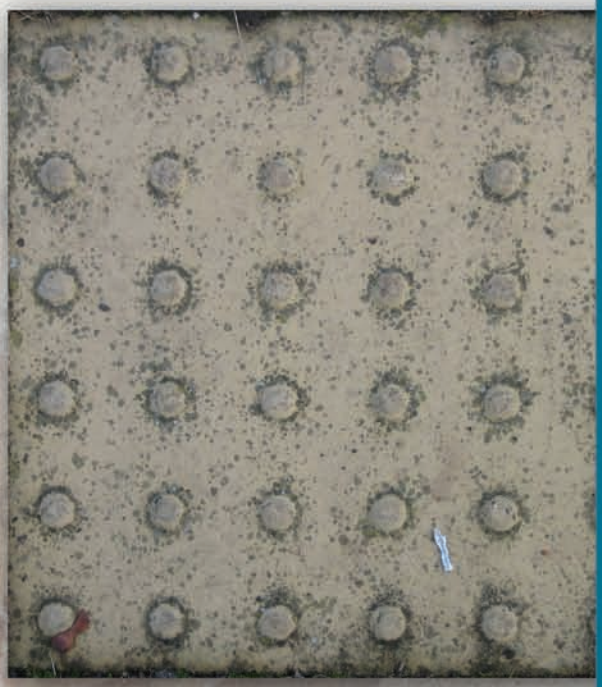

ARRAYS

MATHEMATICAL ASSOCIATION
supporting mathematics in education

Equals

Realising potential in mathematics for all

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Editors' page

At last attention is not focussed only on 'the A to Cs'. In the TES (30.11.07) in front of me as I write "the strugglers" are being considered. The reference might be considered as slightly questionable because the headline suggests that it is the cost of giving them the support they need that is the focus of the article. For *Every Child Counts*, we are informed, the Government has pledged £35 million a year. What is needed, the Advisory Committee on Mathematics Education maintains, is personalised learning and one-to–one tuition in mathematics. Another view that has changed – personalised learning is now fashionable – but not of course mixed ability groups. Does this mean that schools are considered to have failed this population up to now? Teachers have not ignored them we are sure but the press, the politicians and the public have done their best to ignore their existence because they do not help much in the league-table stakes.

Perhaps with all these questions hovering around us it is time to ask ourselves once again the question: what **are** the basics? What mathematics do people need to know and understand to be capable of participating fully as citizens? Fifty years ago the answer would have probably been basic arithmetic - addition, subtraction, multiplication and division. Now that there are so many machines to carry out these processes for us what should our answer be?

The strands of the numeracy framework give us the outline of the answer and an essential overview: *Using and applying mathematics* is surely what every citizen must be able to do. This ncludes *the ability to count, having an understanding of number and knowing and using number facts*. If much of the *calculating* can be, and often is, done for us, skills of estimation must be great enough to check the results. *An understanding of shape* is essential in so many aspects of everyday life and everyone is involved in a variety of *measurement* activities daily. As for *handling data*, the core of information about our world is often expressed in numbers and measures rather than words. We cannot respond responsibly to such information unless we understand it.

All these are areas in which *Equals* attempts to support you in leading your pupils to a clearer understanding of mathematics and, through mathematics, of the world in which they find themselves. This issue includes ten pages of draft material for mathematics that will soon be a part of advice for teachers in training on approaches across the curriculum suitable for pupils with a variety of special educational needs. It replaces our usual double page centre spread because you may like to keep it as a pull-out to be filed with other vital references on the teaching of children with special needs.

The Harry Hewitt Memorial Prize

The prize is being offered again this year so -

Do you have a pupil who has struggled with mathematics and is now winning through?

If so your pupil could be this year's winner

Send to *Equals* a piece of work which you and your pupil consider successful together with:

- your explanation of how it arose
- a description of the barriers that had to be overcome in doing it
- the pupil's age, year in school and the context of the class

Entries must be submitted by 30th May 2008

Which tree do you mean?

An example of an activity on mathematising the world. Mundher Adhami invites colleagues to join in the primary and secondary school trials, together with the group of 10 teachers in Islington who worked on it. These are very much draft materials.

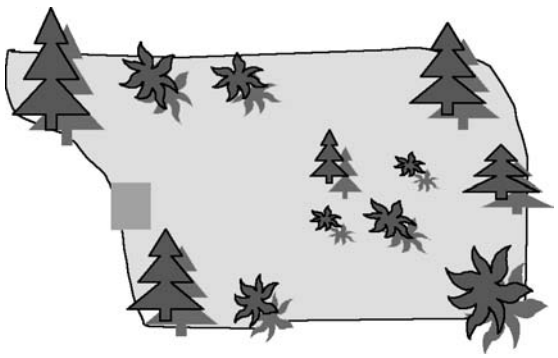
One line of collaborative work by teachers is developing new activities according to some rules. Draft activities are then trialed in the classroom with colleagues observing and taking notes, which helps then to refine the activity, all in the same day. The cycle is then repeated by individual teachers back in their schools. Alternatively, this could happen with colleagues from the same school, working together.

One such activity that seems suitable from Y4 onwards, focuses on ordering the visible world through coding and quantification. It concerns ways of labelling different trees in a park.

The underlying idea in the activity is logical rather than directly mathematical. But the logical idea of two part coding is the same that underlies coordinates, and even place value, where the numerals can be understood as a code with each place representing something different in the world.

Episode 1: (from 10 to 30 minutes) : Position words and devising a code

Story: A gardener and her apprentice have to agree between them on a way of knowing which trees they are talking or writing about in the garden shown here. Ask for suggestions from pairs of pupils talking amongst themselves for a couple of minutes. Initial ideas are likely to include labelling, numbering, lettering.



Challenge: Pupils work in groups of 6, in pairs. The first pair of pupils agree between them on three trees in the garden, and try to tell another pair in words, but not by pointing, how to identify them. The third pair is to watch, and notice difficulties or good ideas in describing positions in words. The whole group has to gradually agree a system and describe it to the rest of the class.

Sharing: The whole class looks at solutions from different groups.
Responses are likely to include:

- Giving directions from the house. Perhaps using compass direction like North West, then counting trees.
- Splitting the 'map' into 4 quadrants, then using top-left, top-right

The teacher conducts a discussion on different issues in order to generalise:

- What order is possible to use to describe positions?: Top to bottom; left to right; clockwise; left and right; outer and inner. Some pupils may suggest a grid as a space organisation. It is important not to take this as 'the answer', but rather to talk about the pros and cons, or ease and difficulty of different ideas.
- How to classify/sort? Large and small trees; fir and bush, and how the type of tree can help in coding the trees.
- The need for two part coding to be agreed (i.e. using some order and some form of classification), then checked for ease of use and consistency.

This episode needs to end with some agreement on describing a few methods/features of position clearly. That would include labelling trees somehow e.g. 'far large fir, top left.

Episode 2: Refining the coding system (The large garden in the flowering season)

Story: As well as the small garden we have already looked at the gardener has to look after a larger garden, seen here in the flowering season.

Challenge:
Can they use their previous or improved system? Is there a better system? (Hopefully a radial system clockwise can be suggested, or a 2 by 2 grid.) Then the labelling of parts becomes important.

What is the least possible number of features needed? This leads to the demand for the shortest ways to describe positions or objects.

Final discussion:
Here is a fuller opportunity to discuss the different coding ideas, together with their advantages and disadvantages. One line of discussion could be why people chose the code they suggest. Some of them may suggest that the code is related to the order of doing work, e,g, starting from the house from left, counting in each 'line of trees'. Others may say they start from looking at the whole map.

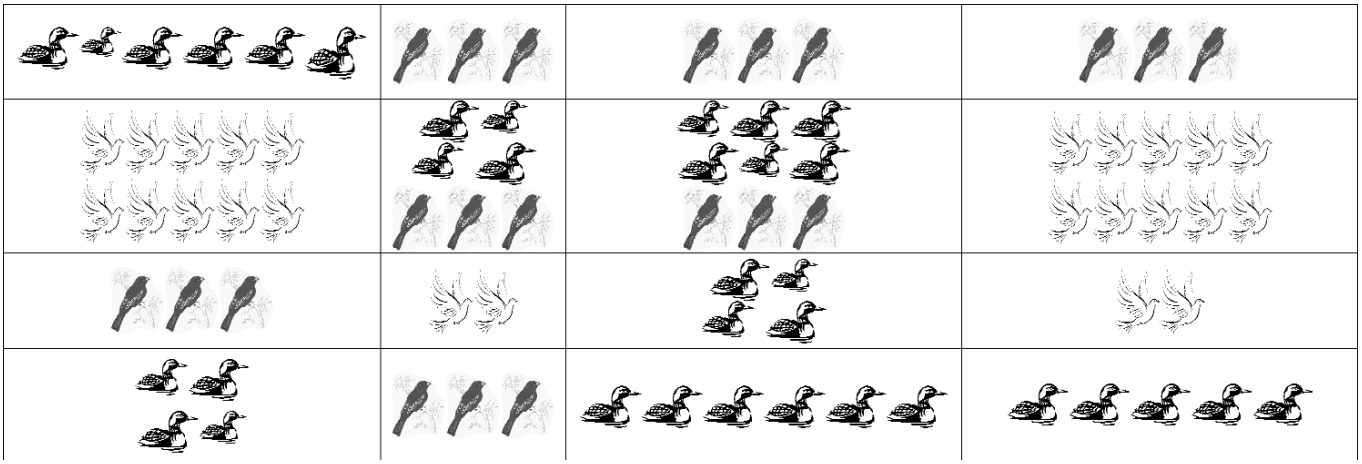
Where the code includes the type of tree, how do they decide if that precedes or follows the number? Is that important? (Most codes are likely to be of two parts AB, and they are placed next to each other in order. A is for some values, e.g. lines of trees, while B is for other values e.g. sequence within the line. So in any code you need a key to the code or a legend in order to break the code or use it

You may wish with some classes to explore coordinates, or rather a grid system, and then discuss ways of coding that. Radial arrangements are also possible, whether in clockwise order or in language description order.

These discussions may lead, in some classes, to the question: What links are there with other mathematics? Hopefully some children will recognise that coordinates are a two-part coding. Also the place value of a 2-digit number is a two-part coding.

Episode 3: Coding a large count
(This can be a separate activity focused on collecting data and counting in groups. It can be linked in some ways to coding, by posing the question whether the decimal place value numbers can also be seen as coding)

Story: In some trees and shrubs live many birds. Each 'cell' here represents the position of a tree or bush. Find a good way to count them and record their numbers. What methods of counting? What methods of recording? There are two positions for the numbers. What is similar and what is different from the coding before?



Cognitive Acceleration Associates

Down Syndrome is no obstacle to GCSE entry in Mathematics

Vikki Horner **cites four cases to show that basic mathematics is accessible to all, through the use of the concrete apparatus she described in *Equals* 13.2.**[1]

Having worked mainly with learners with Down syndrome using structured materials, including, Stern apparatus, I suggest that there are lessons here for all learners. The four different age groups that benefited, and which I give examples as case studies here are:-

- Teenager – National Examination Pass at Entry Level GCSE;
- Adult with Down syndrome – focus on money;
- Primary boy aged 6 with severe speech & language delay;
- Getting started aged 3 – a gentle introduction at home.

Charlotte in GCSE Year

Charlotte has always struggled with maths. At the age of ten, she showed no signs of making any progress with number and arithmetic. At that time, her number bonds to 10 were not in place; counting was sporadic, often lacking one-to-one correspondence, which meant a recount more often than not. Learning with methods, procedures and drill, without conceptualisation, meant that she was going nowhere fast. In contrast, her levels of language, reading, spelling, behaviour and social skills, were all developing well. We worked with other structured materials for just over two years and the plastic number shapes were the first materials that began to help Charlotte develop some idea of the meaning of numbers.

For the past three years she had moved on to Stern apparatus and teaching. In year 10 (aged 15) the school worked with Kit B and in discussions with the mathematics teacher, we worked together to help Charlotte prepare for her national exams. We had one year to work through the contents of the exam paper. School provided me with the teaching schemes, and I found the relevant teaching in Stern programmes. We both worked there first. It was important to give Charlotte the best opportunity to 'see' what was being taught using concrete apparatus. Having only one year to prepare was a humongous task and it was necessary to straddle two Stern programmes which was not ideal. The premise of Stern is that topics are taught in small steps building on previous knowledge, so gaps in Charlotte's understanding were inevitable. Nevertheless I was happy with that, and was so proud of her ability to sustain the level of input required. Mind you, bribery ran rife (even including a new keyboard with a microphone!) and I became very creative in helping to maintain her levels of enthusiasm for the task!

Note: One of the hardest elements to tackle was the mathematical language and this should be given much more of a focus - and as early as possible - because the mathematical skill may be in place but the language used within the curriculum may not give the pupil the necessary associations, as was the case with Charlotte.

Mathematics teacher Jane Powell said: "*...We used the Stern programme to support the Number Strand of the Entry Level Mathematics Course. The school worked with Charlotte's mother, providing copies of the scheme of work and sample test paper,s and kept her informed of the topics being covered. Charlotte was then able to continue her work at home. Using the Stern equipment: the Number Track, Dual Board and 20-Tray provided both visual and kinaesthetic learning experiences. The short term targets and frequent repetition of Stern's programme was also ideally suited to Charlotte's style of learning. We learned a great deal from using this programme. In particular, mathematical language – we felt that there is a need to begin linking the language of the National Curriculum at a much earlier stage because this left Charlotte at a disadvantage in the public exam. Nevertheless, Stern was a significant factor in Charlotte's success in gaining the Entry Level qualification*."

Eamonn, aged 36

I met Eamonn at a Numicon training course in Carlow. Eamonn told me he wanted to learn more mathematics to help him use money which was music to my ears! Eamonn was a quiet, willing and self-motivated student and I really enjoyed the year spent working with him. I introduced him to Numicon initially and covered basic elements such as odd and even numbers, doubles and neighbours (consecutive numbers). It was fantastic to see how quickly he grasped these concepts with real understanding. I recall him saying, "*So that's what that means!*" as we tackled odd and even numbers with the plastic shapes. In a couple of hours we were able to develop this understanding further using only an ordinary pack of playing cards. A short while later we moved on to the Stern apparatus, offering more opportunities to learn concepts in a variety of ways. We quickly worked through the number bonds 1-10 to familiarise him with the apparatus, gradually extending the range to addition and subtraction up to 100. Eamonn came to the UK twice and stayed with us for a week's intensive teaching, and also had another week's work with Charlotte. It was a great opportunity to teach both Eamonn and Charlotte together, and wonderful to see just how much progress he made during this period, in particular with his confidence and self-esteem.

Clinical Psychologist Assessment:
The following extracts were taken from a follow-up assessment by a Clinical Psychologist in Co. Tipperary:

> "*....Eamonn readily engaged in the review procedure with ease and with confidence. Eamonn described his work to date. I am pleased to report initially considerably enhanced and improved self-confidence for Eamonn in relation to both literacy and numeracy skills. Mathematical abilities particularly in the area of mathematical reasoning show enhanced skills. Here, Eamonn displayed an increasingly improved knowledge of strategies requested of him within mathematics....*"

There was significant improvement (over a year in age equivalence) in mathematical reasoning, in subtraction in mental arithmetic, and, most importantly, in using money! Another interesting element at assessment was that Eamonn's levels of literacy had also improved!

Stanley, aged 6

My latest pupil is Stanley, a lively 6-year-old boy with Down syndrome who has major difficulties with speech & language. I began to tutor Stanley at the end of April on a weekly basis and twice weekly during August. In our first session he took to the materials immediately, was totally engaged and his concentration was lovely. The session was fun, with the occasional 'testing' on Stanley's part whereby I consistently gave the same message: laying down boundaries. I was really surprised to see that the first lesson had lasted forty minutes! He filled the counting board trying varying sized blocks to match empty grooves, saying "ooh bi' (too big)." When a block didn't fit, he took it out and selected a smaller one. With the 10-box I put in a large block and asked him to find a block to fit the gap. The scanning and judging sizes of blocks practised in the Counting Board transferred readily to the work in the 10-Box where, he was left to discover for himself the block that fitted. Because of the language delay, I included a focus on the language of colours, easily facilitated by the brightly coloured blocks. I painted some bricks to fit into the empty spaces above the number block grooves in the Counting Board, and made a set of coloured cards for further reinforcement. For example, after Stanley had placed the number blocks correctly, a brick was selected from a feely bag and matched to blocks, providing more verbal practice. Next came the card game - turn over a card, say the colour. He liked to take out the same coloured block and brick and place it on top. We used a second set of number blocks to find the 'twin' block where he delighted in saying 'same' or he sometimes stood them next to each other 'measuring' them.

After 12 weekly sessions, Stanley knows where each block lives in the Counting Board and knows the colours (assessed by the correct positioning of the bricks above the blocks). He is vocalising some names of colours more clearly and he can recognise and construct the patterns 1 to 6. From seeing the pattern I have built with cubes, he can select the appropriate Pattern Board from a table nearby, (showing that his memory/receptive language is being developed). After much repetition we are working on sequencing the blocks.

I place the first block in the Counting Board and say, "This is the smallest block and it goes here." I point to the next groove and say, "Which block comes next?" The familiarity of the size and place of the blocks from previous discoveries, transfers to this activity which Stanley tackles with confidence and his actions to the words 'next' and 'after' describe what the words mean. This is in place from exposure to the materials once a week, think how much more can be achieved if this became a daily activity?

Gentle Introduction for children aged 3 and above

Children aged three can begin to play with Stern's apparatus as part of the regular routines of early intervention at home or in Nursery/Pre-School setting. The Pattern Boards are a good place to start. The cubes are a good size and will aid fine-motor development. Guidance is required when placing them into the Pattern Boards, to teach left/right directionality. As the patterns get bigger; cover up the cube spaces allowing the child to work with one row at a time. This maintains the small step action. On the Counting Board, cover with a piece of cardboard leaving only the grooves 1 and 2 exposed. Show the child these blocks in the Counting Board, then give the child a block and let her/him try to fit it in the correct groove. Extend the number of blocks appropriately. Take the corresponding Number Box, say the 3-Box (to coincide with blocks practised in the Counting Board), with appropriate blocks, then together, fill it as though it were a puzzle. These boxes are great to practise colour. Take the 100 coloured cubes and say the 5-Box (Yellow inlay) and ask the child to find the yellow cubes and put them in the box.

Conclusion – Children with Down syndrome are visual learners and require much structure to help them to succeed. Stern apparatus and small step approach will offer many opportunities for success. And, as mentioned earlier, this method is ideally suited for many different learning profiles, children using Stern are eager to learn and have a lot of fun on the process! Try it, you won't be disappointed.

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Vikki currently advises and provides training using Stern's Structural Arithmetic.

1. For lliustrations of the Stern apparatus see Equals 13.2 pp 3-5

Pages from the past

School's ways were not my ways

Gwen Raverat reveals more of her feelings about schools and governesses in the 1880s.

The classics at their most classic – studies not of literature but of words and grammar – were then considered by pubic school-masters as the only proper learning for boys; anything outside Latin and Greek were frivolous hors-do'euvres. When Charles won a prize for history at Marlborough, the headmaster wrote in his term's report: 'This shows that he is not a *mere mathematician*.'

I was sent to a small private school; an excellent one in its way no doubt; but it was not my way.

I must not be ungrateful: I did learn a great deal at school, and grow and widen too. I am glad I went there. But it is no use denying it: I don't like boarding schools; although they are better than governesses. Day schools might be better still, but I never went to a day school.

Iraqui people's solidarity congress in Ashraf

June 17 - 121 political parties and social groups, 700,000 women, 14,000 lawyers and jurists, 19,000 physicians, 35,000 engineers, 320 clerics, 540 professors, 2,000 tribal sheikhs and 300 local officials among signatories.
Iran Liberation July 2006

How do you rate yourself?

Draft Subject Booklet for trainees in Initial Teacher Training:Primary Mathematics

Mathematics and Every Child Matters

Background to Every Child Matters

This section is an introduction to the ideas of Every Child Matters through the perspective of the mathematics curriculum. (taken from: www.everychildmatters.gov.uk)

In 2003, the Government published a green paper called Every Child Matters. This was published alongside the formal response to the report into the death of Victoria Climbié, the young girl who was horrifically abused and tortured, and eventually killed by her great aunt and the man with whom they lived.

The green paper built on existing plans to strengthen preventative services by focusing on four key themes:

- Increasing the focus on supporting families and carers - the most critical influence on children's lives
- Ensuring necessary intervention takes place before children reach crisis point and protecting children from falling through the net
- Addressing the underlying problems identified in the report into the death of Victoria Climbié - weak accountability and poor integration
- Ensuring that the people working with children are valued, rewarded and trained

The green paper prompted an unprecedented debate about services for children, young people and families. There was a wide consultation with people working in children's services, and with parents, children and young people.

Following the consultation, the Government published Every Child Matters: the Next Steps, and passed the Children Act 2004, providing the legislative spine for developing more effective and accessible services focused around the needs of children, young people and families.

Every Child Matters: Change for Children was published in November 2004 and a website: www.everychildmatters.gov.uk was launched soon afterwards.

The key outcomes for the Every Child Matters (ECM) agenda were drawn up after the consultation with children, young people and families. The five outcomes which mattered most to children and young people are set out below. Each of the five outcomes can be addressed through the Mathematics curriculum.

Below each outcome is explored with suggestions for how this might be addressed for children with special educational needs. Not everything will be appropriate for all, but within each generic and specifically mathematical list, there should be something for all. This list is by no means exhaustive and should be regarded as a starting point rather than a prescription or restrictive in any way.

ECM Key outcome	Generic educational aspects	Through the mathematics curriculum
Be healthy	• Work towards independent learning. • Actively enquire about differing environments. • Maximise physical, mental and emotional health. • Understand own needs and how to satisfy them – physical, mental and emotional. • Make positive relationships with others.	• Learn to cook healthy meals – measuring quantities and time. • Learn to weigh and measure self – learn how to keep fit and avoid obesity. • Understand about the effects of alcohol and drugs.
Stay safe	• Keep safe in school and on school trips. • Work towards keeping safe when unsupervised. • Have stability and security. • Know about their place in the wider community. • Understand about appropriate and inappropriate behaviour of self and others. • Know where/who to go for help and support.	• Understand risk and how to minimise it. • Understand 3D environment especially road use. • Understand effect of speed on effect of impact (road and rail traffic).

Enjoy and achieve	• Achieve personal and social development. • Enjoy lessons. • Achieve to their potential. • Use alternatives to written recording where appropriate. • Develop ability to ask for support appropriately.	• Enjoy mathematical challenge or puzzle. • Appreciate own success – positive self-assessment. • Learn to find place using street map e.g. Park, leisure facility.
Make a positive contribution	• Contribute to decision-making by making their voice heard (in school and the wider community). • Help and support others. • Be aware of and contribute to charity work – e.g. Red nose day, Children in need. • Analyse options.	• Contribute to and listen to class discussion. • Show own work and thinking. • Comment positively on another's work (peer assessment).
Achieve economic well-being	• Learn about ways to ensure their own economic well-being in the future. • Work towards independent living.	• Understand and use money. • Learn about debt and how to avoid it. • Develop understanding about gambling in terms of chance of winning & losing. • Budgeting. • Value for money.

Self audit for inclusion in mathematics lessons:
How trainees and teachers plan their teaching, learning and support

The self-audit has been written because of the demand for a straight-forward way for teachers and trainees to consider how inclusive their mathematics classroom is. We would be grateful to know:

- *if you feel the self-audit is generally useful.*
- *whether there are ideas we should include or revisions we should make.*

The following self-audit list may help you reflect on aspects of the classroom environment which affect the learning of pupils with SEN and/or disabilities. The aim is a classroom ethos where all pupils feel confident, valued and able to contribute. This is conditioned as much by the physical environment and managing other adults effectively as by planning and modifying mathematics work for pupils with SEN and disabilities. All factors should be integrated in the conduct of a lesson responding to the diversity of pupils with their particular range of needs.

The physical environment	Always	Sometimes	Seldom/Never
1. A welcoming classroom space with relevant mathematics displays in number, shapes, data handling and pupils' own mathematics work, including that of pupils with SEN and/or disabilities. Visual timetables and prompts about what to do independently and how to ask for support.			
2. The main board uncluttered with disparate writing, and frequently cleared to focus the class attention on the immediate work at any one time. Special spaces for special needs through consultation.			
3. Background noise avoided, while allowing the class to respond and orally interact in natural ways, including chanting, without distracting other classes. Sound and light issues considered for all pupils with SEN.			
4. Pupils' seating and the main board position carefully planned for the shape of the room. Often a semi-circular arrangement of pairs of tables with whole class shared space in front of the board is appropriate. It should allow for the groupings for peer or adult support; sufficient room between chairs for pupils with mobility difficulties; clear view of board for all pupils; room for left-handers.			
5. If a 'carpet time' or another way of whole-class sharing is planned, certain pupils need to be given their own space for access and participation.			
6. Resources are accessible and clearly labelled. Equipment colour coded and labelled to encourage independent use.			

Planning for the lesson	Always	Sometimes	Seldom/Never
Support planned for SEN individuals or groups in terms of resources. eg. large font handouts, simpler or extension worksheets. Visual aids, eg. measuring equipment, checked for clarity. Sound or tactile aids available as necessary.			
Pre-tutoring for certain pupils (eg. on mathematical vocabulary or context of learning).			
Questions prepared in different styles/levels for different pupils.			
A distraction-free area planned for pupils who may need it.			
Tasks linked back to earlier objectives or focused on investigating a topic, mathematising a situation, discussing or finding flexible ways to solve a problem, rather than the learning of a formal procedure. Scaffolding planned for some pupils.			
Other adult support targeted at individuals or groups.			
Teaching assistants clear about learning objectives/individual targets and deployed so that they encourage pupils to work independently when they can.			
TAs prepare resources (eg. task cards/simplified maps); to pre-tutor certain pupils (eg. with mathematics vocabulary, link with previous tasks) and to prepare themselves to simplify, scribe, and sign for pupils within a 'scaffolded' approach; to support pupils in assessment for learning.			
Where appropriate, ICT planned as an access strategy (speech or sign-supported software/on-screen word bank / predictive word processing/ digital cameras).			

Responsive lesson conduct	Always	Sometimes	Seldom/Never
All pupils clear about duration and overall structure of the day and the lesson (visual timetables referred to).			
An engaging lesson start, eg. a story or another 'hook' that allows various pupils in their ways to focus attention on something shared, often not directly mathematical at first.			
All pupils clear about the mathematical or logical task at the start of the lesson, eg. whether it is to practise some procedures, or generate ideas in any flexible ways for sharing. Key words, meanings and symbols negotiated and may be written up.			
Lesson runs in two or more cycles, as appropriate, of sharing time and independent work, individually, in pairs, or in groups. The sharing time periods are used to acknowledge all contributions and also to refine and focus the flow of work.			
The level of challenge should either be maintained or rising during the lesson, so that all pupils are working at their level or manageably ahead of themselves. Pupils accept that being challenged is good and that handling difficulties is a major aim of learning.			
During independent work period you give support and hints to different groups or individuals, keeping in mind their ideas and even priming some for a fruitful sharing period for the rest of the class.			
Responses to errors recognise the value of the thinking that led to it, since most errors are mixing of logical steps and or attention. Discussing common errors allows pupils to feel freer to handle mathematics, not frozen by fear of mistakes.			
Paired talk or buddy talk encouraged to maintain attention or to link concepts to pupils' own varied experiences. Manageable mixed ability grouping or pairing is the norm except for extremes of the range.			
Transition from whole-class to independent/group work, and back, is clearly signalled. Praise for pupils keeping the rules and not excessively chastised for minor transgressions. Humour works wonder at times.			
Oral interactions and explanations of thinking out or through the mathematics is valued over and above neat recording except in the special cases for which it is needed. Alternatives to written recording offered where appropriate (eg. acting out and body language, scribing, mind maps, voice activated software and other use of ICT).			

End of the lesson and after	Always	Sometimes	Seldom/Never
1. Rounding off of the lesson involves a sharing period and some conclusions aimed for some parts of the lesson to be retained.			
2. End of the lesson discussion can focus on one or more of the mathematics ideas explored and the progression to them during the lesson. This involves rehearsing early and unusual ideas and wordings, including those from the pupils with SEN and/or disabilities, thereby ensuring that all levels of attainment are included.			
3. End of lesson discussion can also focus on the ways of working in class that have been found fruitful, eg. pair work, use of apparatus, and visual presentations. Praise for pupils making progress in collaborative working or sticking to task despite barriers.			
4. Main points concluded or arising from lesson noted down and left on the board. Teaching assistants rehearse feedback with some pupils.			
5. Pupils who remain puzzled and realise they have not fully understood or solved the task, encouraged to accept that is a fruitful state of mind valued by the teacher and advised on working further on their own or seeking help.			
6. Pupils who are confident with the knowledge and insights they gained are encouraged to see where else in mathematics or other subjects this knowledge is relevant.			
7. When appropriate the next stages of pupils' learning are signposted and highlighted for individuals or groups to ensure they remain challenged.			
8. Notes made on individual pupils about difficulties/successes in the lessons, based on their contributions rather than merely on written work, which needs only to be assessed in certain conditions and after chances of reworking.			

Summary chart

A summary chart is to give teachers ideas for the removal of particular barriers in the classroom. We would be glad to hear your ideas on adding to the chart concisely or any other suggestions for revision.

Area	Prepared support	Activities	Software (examples)	Hardware (examples)	SEN
Language and communication	Tasks pre-taped on audio or videotape. Symbols and other alternative communication systems: take time to find out the way of communicating that suits the child. Pupil grouping (eg. buddies) across attainment levels.	Simulations and games for practising situations. Additional adult prepares pupil(s) for question and answer session.	Word banks on computer files. Pictures and diagrams e.g. clipart.	Good acoustics in class. Sound field systems to support poor acoustics.	SLCN ASC
Concepts, vocabulary	Cards with words and pictures expressing the idea. Concrete and multi-sensory resources. Learning terms through a range of curriculum areas.	Pre-teach key concepts. Wordscapes Story maps Care with metaphor 'Mouth of river'etc.			SLCN ASC MLD
Writing	Pre-devised writing 'frames': computer files to scaffold pupil's writing. Changes to key press functions/ font size/colour settings.	Word processor for drafting and re-drafting. Spelling and grammar checker.	Planning software e.g. *Inspiration.* Talking word processor with word predictor *Texthelp* Co-writer Write: *Outloud.* Touch typing training.	Good colour printer for quality & valued result. Portable tape recorder for note taking. Voice activated word processor.	Dyspraxia/ Develop-mental Coordination Disorder Dyslexia

Reading	Use of story and narrative. Texts which are rich in rhyme and repetition. Some large text books. Font size: at least 12. Font: Arial, Comic Sans.	Symbols and text together in prepared material. *Writing with Symbols Clicker.* Additional adult prepares reading with group before lesson. Shared text work.	Talking word processor *Texthelp.* Read & Write Making books that are meaningful to the reader. *Communicate in Print.*	Enlarging photocopier. Large display calculator/ talking calculator.	Dyslexia/SPLD MLD VI
Reading from the internet.	Changing the look of the screen: typeface, colours etc.			Use of 'simplifying' browser such as Widgit Software Webwide.	Dyslexia/SPLD MLD
Analysing and interpreting/ problem solving.	Step-by-step descriptions of the procedures to be followed.	Databases and spreadsheets of various degrees of sophistication.	*Excel*	Data logging hardware Digital camera.	
Improving own learning and performance.	Taped details of project in hand. Survey of equipment available to pupils for independent study. Access to internet.	Symbol or other visual schedules and timetables. Schedules for fair use of equipment.	*Kidspiration* *Microsoft Office* calendar	'Handheld' devices, such as personal digital assistants allow extended practice of mental mathematics.	

Motivation	(Most ideas on this table contribute) Teaching to build confidence through targeted praise. Avoidance of 'culture of right answers'. Reduction of anxiety by carefully chosen tasks, building on pupils' preferred methods and encouraging collaborative working.	Ability to take risks safely e.g. through simulation or design packages. Structured software with high rewards.	*Excel* Problem-solving games. *The Sims* *Successmaker* (suits some pupils better than others)	Digital cameras allow instant records of eg. patterns in the environment. Photocopier/ scanner for rapid back-up of work.	BESD
Presentation	Word processing etc programmes for quality handouts.		*Powerpoint* Can be used to create pupil interactive resources. Word including charts.	Interactive whiteboard. Accessible technology. www.rnib.org	Dyspraxia or Develop-mental Coordination Disorder Visual impairment
Mobility	Risk assessment to allow challenge cf Wiegand & Beveridge (1999).	Sensory trails, multi-sensory environments, such as simulated rain forests. Theatre, role play, reconstructions. Carefully designed first-hand experience of site visits and fieldwork.	Google Maps	Video-conferencing	PD Sensory impairment

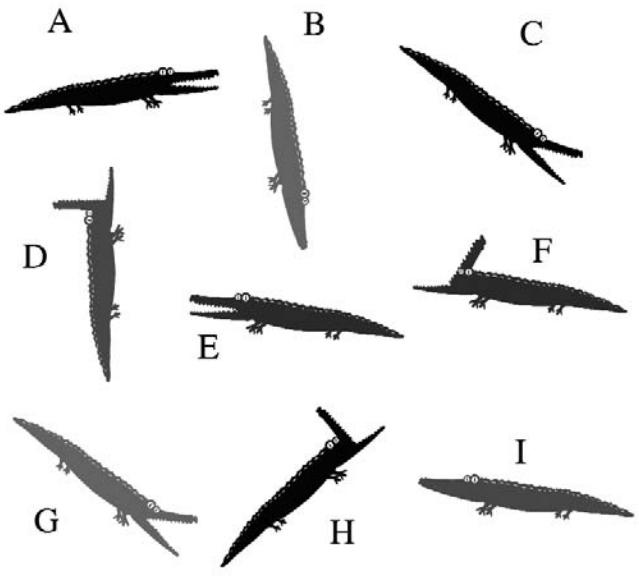
The Day I Learned What Inclusion Really Means

Alan Edmiston **learned a few things about inclusion in the primary school through having to cope with an unexpected mix of ages in a large group. The activity he chose 'took off' both in terms of mathematics and of children learning to think for themselves.**

My phone told me I had a text and it was not good news. The night before I was due to host a mathematical problem solving day for Key Stages 1 and 2, one of my key helpers dropped out. This was of great concern, and source of immediate stress, as she was due to take the lead with Year 3. "What can I do with those 12 children?" was a question I asked myself for the next 3 hours. I could not ask Cathy at 9.00 pm as she would not sleep - she was worried enough at helping out with Year 4.

In the end I decided to mix the children from Years 1, 2 and 3 for one of the sessions and juggle some of the others without the need to involve other people at such short notice. The activity I chose to use with 36 pupils aged from 6 to 8 was one called 'Hungry Crocodiles', a powerful introduction to angles delivered via a simple everyday context. It relies on children deciding:

- Which of crocodiles in pictures are hungrier than others by their jaw opening.
- Ordering these openings and think of three kinds of opening



- Work similarly on open and closed scissors, moving to the notion of Angle
- Develop the three types of angles : wide, narrow and middle or Right

I will explain more about the activity itself later but that chance decision, one which I was forced to make in desperation, proved one of my best that term.

I realised how good that specific activity had been when the pupils began to feedback on the day. Each group of children (5 or 6) had to present their thoughts on the activities to the rest of us (some 70 others) in the main hall in a style of their choice. Rather than paraphrase what they said I will include the comments made by the pupils themselves.

- I thought about the ideas in the story and the ideas of the others.
- We got together and made new friends.
- The difference is we had fun while working.
- Your thoughts start smaller and get bigger.

- We thought we were going to do hard maths but we did thoughts.
- Coming here made me smile, happy and think about things.
- It's good to meet and make new friends.
- I learnt to think more, I thought about my thoughts. I leant that when a crocodiles mouth was wide it was hungry.
- When we wrote things down it made us think. The describing words helped me to think.
- Putting things in order helps you to work things out.
- I thought about making new friends. I did not think it would be loads of fun. It made me think about measuring.
- I feel today has really helped my ability to do maths. Alex helped by being funny. I made a friend today who gave me a good idea. I could see him work out the answer.
- I could ask a friend to help me. I enjoyed it with my new friends. The teacher gave us some excellent clues about how to do the work.
- I learned that talking with friends makes work easier. It really made me think about problem solving. It was different because we were not in school.
- We learned that you need to look at things differently to see things properly. Today was fun and we meet people from different schools that made us smile. We liked looking at the hat and glove and trying to find a link between them.
- All this talk about thoughts has made me think about looking at things in a different way, different to the way I normally look at them.
- When you share ideas they can become bigger because your friends can add on and improve.
- I learned if you work together you can share ideas and solve the problem.

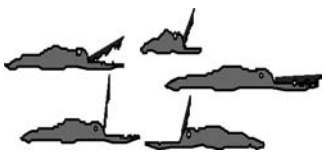
You can imagine how happy I was that night as I began to type up their reflections. What struck me was that in the end all my plans amounted to nothing and simply putting 6 to 8 year olds together to work on an engaging problem resulted in an outcome that was so much better than I could have imagined. What I did do, however, was to choose a task that enabled the pupils to access into and engage with it at a meaningful level.

Hungry Crocodiles begins with a decision about which crocodiles are hungry before progressing to deciding which scissors are the safest. The pupils then draw their own small, middle and wide angles before seeing the same three categories in the world around them. They emerge with a firm understanding of a angle as a frozen turn that is not dependant upon the size of the sides or arms involved. The lesson can be found in the Let's Think through Math's 6 – 9 pack, published by nfer Nelson.

Looking back to the day in June what really strikes me now is that all pupils have the ability to see the world through the lens of mathematics and in many ways all I need to do is to provide a chance to focus the area of attention. If I do this then once they start talking the maths begins to emerge and develop.

Guidance I used in the lesson

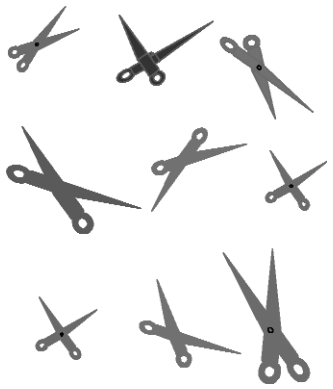
Episode 1 Focusing on the turn

Story Jaws opening wide or narrow Start with a story about crocodiles in the zoo opening their jaws to tell the keeper how hungry they are. The wider they open their jaws the hungrier they are. Give out the worksheet. Talk about how hungry each croc is, and how crocs are large or small, but that has nothing to do with how hungry they are. Children talk about the smallest crocodile being hungrier than the largest one. . But is there a still hungrier croc? Also some crocodiles have different length upper and lower jaw. And they are facing different ways.	Recognising and naming elements of a situation.  Separating angle independently of irrelevant features.

Challenge to pairs: Ordering and sorting pictures.
Children classify crocodiles into three sets cutting up a worksheet. (you can help in this but the scissors are available for them to use and look at.). They do the same with the scissors worksheet. (This can be cut out to speed-up the move to comparisons)

Sharing: Ordering/sorting angles.
In whole class discussion children agree on the three sets that combine the Wide, Narrow and some Middle angle in their own words.

Looking at other objects that make a turn: a **book** or a folded sheet from the side, the **door**, the window, a folded mirror. They try to describe what an angle is.



Angle as independent from objects, size of "arms", and orientation.

Linking to other situations.

Episode 1 Focusing on the turn

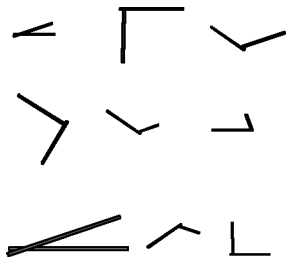
Story: Hinged sticks as a model for angle.
Show two sticks linked at one end, and talks about different turns, and how they can be recorded on the page. Steer them to agreement on the Wide and Narrow angle and the Right angle in between

Challenge to pairs: Sorting of drawn angles.
Using worksheet 3 and pairs of hinged sticks children categorise pictures by size of angle without cutting, ignoring other variables. They use their own two hinged sticks to measure or compare angles. Then ask them to draw on an A3 their own Wide, Narrow and Right angle, one of each type.

Sharing: Finer ordering of angles.
In the sharing children collect all the angles placing on the board in three sets, the narrow on the left, the right angles in the middle and the wide angles on the right.
Within the narrow angles sets agree on the order from the smallest to the widest, again from the left to right. The sticks can be useful to compare angles that look similar. Children should discuss again how the length of the arms has nothing to do with the size of the turn. Do the same within the wide angles. Then go to the right angles and conduct a discussion why they are all the same size.

Mini-reflection:

- What is the widest possible angle? Can a straight line be an angle?
- What happens when the two sticks turns more than the widest? How do we know which angle to talk about?



Angle as the amount of turn around a point. They can possible use the sticks to 'see' angles in shapes.

The Right angle as a special case, at the border between Narrow and Wide.

Extending the turn to reflex angles and relating it to the full turn around a point.

Summing Up

What really struck me was the fact that all my careful planning came to nothing in the end. What made the real difference and helped me to grasp what inclusion is all about, was providing the chance, and a structure for children of different ages to sit and talk about their thinking and not about my objectives. All they needed was something to stimulate them and a focus for their talk plus the time and space to develop and refine their thinking in dialogue with others. Neither age nor ability was a factor.

Pupils were able to share:

- the wonderful things going on inside their minds
- their ideas and not their knowledge

and, in the process, they were able to connect with the struggle to make mathematical sense of the world, a struggle that is a defining feature of human society.

The day ended up being less abut teaching and more about children reaching out in their thinking as they sought to make mathematical sense of the complex world around them.

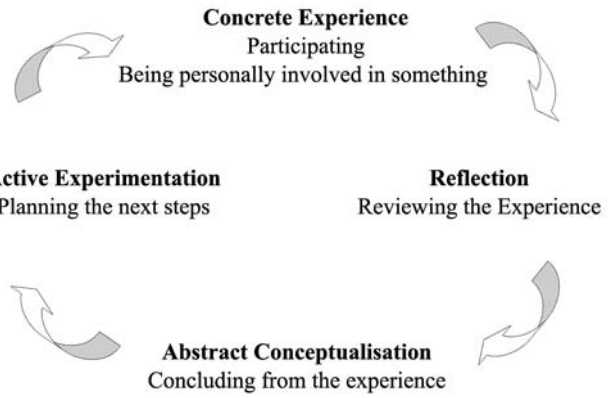
Senior Thinking Maths Tutor

Which learning style suits you?

Mike Bailey reminds us of the importance of making the learning style fit the learner

When considering learning it is worth thinking about the concept that we each have a preference for the way we learn, a preference for a certain type of learning style. Over the past 40 years theorists have identified a range of 'learning styles' which group together common ways people learn. 'Learning styles' can be useful theories to employ when thinking about the learning and development opportunities which will most benefit you and your pupils.

David Kolb, a professor of organisational development, first published his cycle of learning theory in 1984.



Kolb believes that in order for successful learning to take place all four stages of the above cycle need to be experienced. He felt that people would often have a preference for one of the four stages.

The first stage, the 'concrete experience ' may be part of a recognised learning experience or something in work or personal life. The second stage involves the person thinking about that experience, how it felt and what they understand by it. Moving into the third stage the individual starts to understand the experience by relating it to similar experiences or theories they have previously come into contact with. The final stage is where the individual formulates ideas about what actions to take when this experience happens again. They may decide to do the same thing again or something different and have therefore learnt from the process.

Based on Kolb's work Peter Honey and Alan Mumford in 1986 created their four learning styles of Activists, Reflectors, Theorists and Pragmatists. Activists by their very name love throwing themselves into things and involving themselves in new challenges.

Being flexible and enthusiastic, they can sometimes do things without thinking. On the other hand, Reflectors like to stand back and look from afar thinking about what they have experienced before making any conclusions/actions. They are thorough, which can make them slow and cautious decision makers. Moving on to the Theorists, they are very logical and like system approaches and theories based around facts. They have a low tolerance level and dislike uncertainty. Finally, the Pragmatists are quite practical in nature, liking to try out new ideas. They can sometimes be more interested in the project than the people involved in it. Again Honey and Mumford' s theory was based around the idea that people would usually have a preference for one of these learning styles. Relating it to Kolb's Cycle of Learning, the stages where each of the styles would feel most comfortable are:

Concrete Experience – Activist, Reflection - Reflectors, Abstract Conceptualisation – Theorists and Active Experimentation – Pragmatists.

Alongside these theories is another which categorises learning styles in terms of visual, auditory and kinaesthetic. These are the most commonly used learning styles. They are based on the idea that we use our senses when we process things and we will use one sense more than another depending on our preference. A visual learner will tend to learn best through reading, looking at pictures and diagrams, and watching demonstrations. Auditory learners on the other hand will tend to prefer to listen to information learning through hearing people talking. Kinaesthetic learners like hands-on activity and learn best through doing something to understand, they can be quite tactile.

Each of these styles of learning can be useful, enabling you to think about the ways you prefer to learn and allowing you to choose those learning activities that best suit your preference. This will enable you to get the most out of your own learning and understand better the preferred learning processes of your pupils.

East Sussex

One thing leads to another

Jane Gabb looked around her local environment and found a whole series of teaching and learning ideas.

I needed some photographs of rectangular arrays for some work on multiplication and division with teachers. I find they are one of the best ways of helping children to understand what multiplication and division are and how they relate to each other.

I took my camera for a walk around my local area and within half an hour I had taken about 50 photos of various doors and windows, drain covers, trellis and paving stones that I found on the way. I then came home and photographed bun tins, egg cartons, wall tiles and chocolate from around the house.

While I was doing this several things occurred. Firstly I became very attuned to the number and variety of arrays around the place, and it struck me that it would be a useful exercise to recommend to teachers in the first instance, and then to their pupils. Secondly I decided that I wanted to include among the collection, arrays which were not rectangular or that did not work as a multiplication/division picture. I always like counter-examples as I think they help with the tuning in process, and it's important that children (and teachers) are aware that not everything is in a rectangular array.

As I took the photos various questions started coming to mind. A generic question which could be used with any picture is:

- What can you see?

Questions which can be used with any rectangular array are:

- What multiplication and division facts can you see in this picture?
- Can you write 4 number sentences using x and ÷?

In the case of a square array, a follow up question to that last one is:

- Why not?

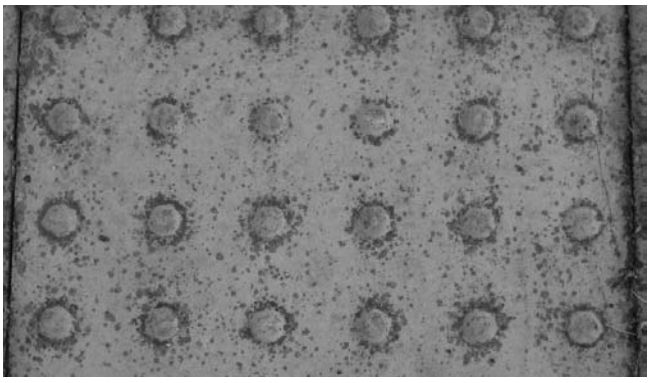
In the case of a non-rectangular array:

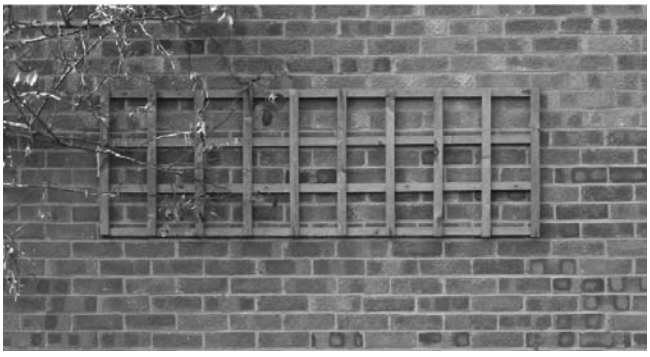
- Can we use this to show a multiplication or division fact?
- Why not?
- What would we have to change so that we could?

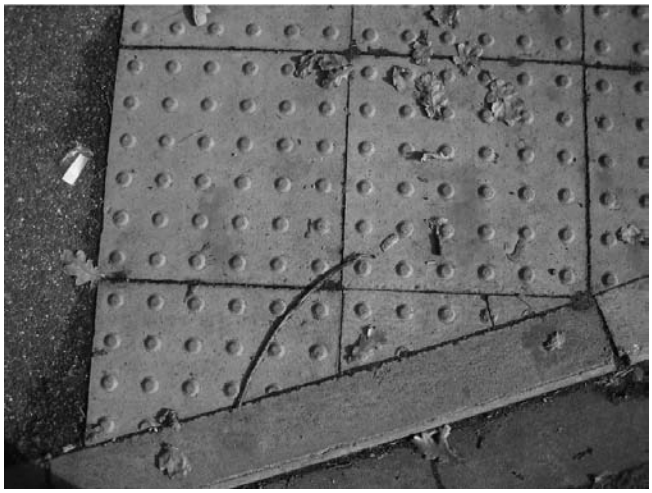
In the case of the whole array not being visible (e.g. pots and pans obscuring kitchen wall tiles or a car covering part of a garage door):

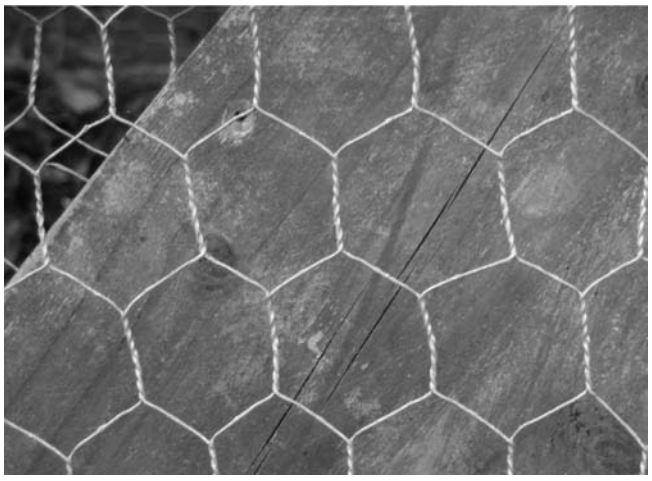
- How can we work out easily how many tiles/panels there are in this picture?

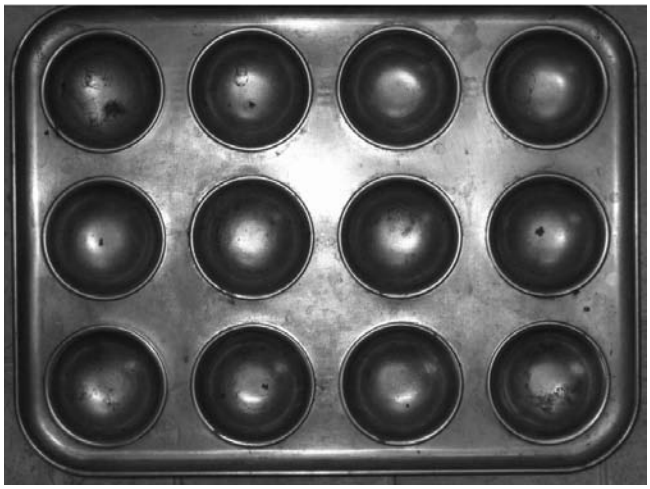
When I had downloaded the pictures I put them into a powerpoint presentation, and wrote the questions on the notes pages for the different photographs. (A few examples are shown here.)

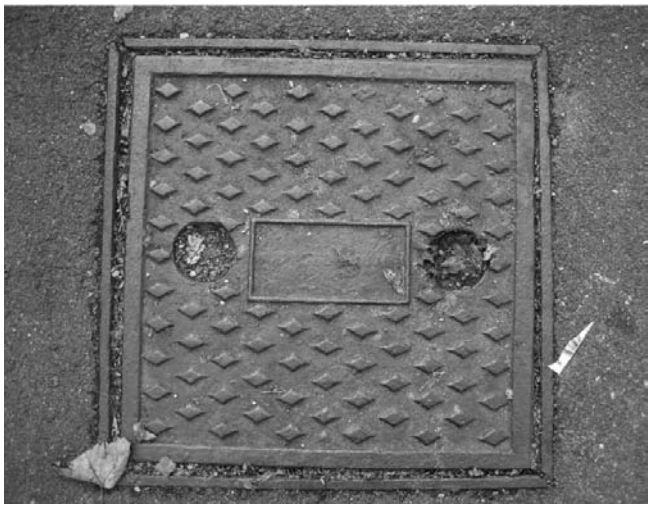


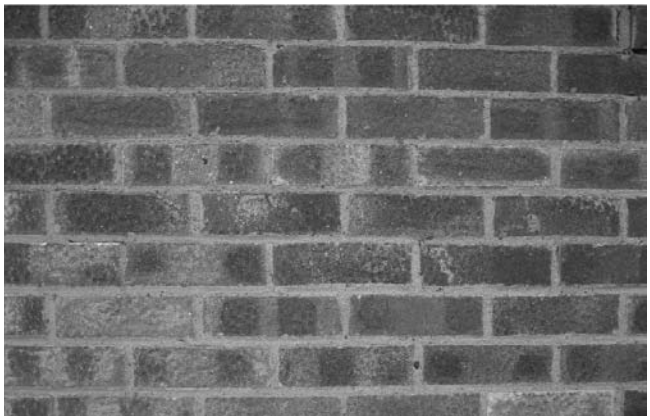












It was while I was doing this that I started thinking about how useful chocolate could be in teaching a number of related topics.

First of all, many chocolate bars come in squared off pieces which are arranged as arrays. You can uncover part of the bar and ask for methods in determining how many pieces there are in that particular bar. This can be a question of simply applying the array fact (if 2 of the sides are fully revealed) or estimation followed by multiplication (if less than this information is given).

Then I envisage an investigation (or a series of investigations), which might go something like this:

- Why is it important to know how many pieces of chocolate there are in a bar? (Something about sharing the chocolate might be a response here.)
- What would be a good number of pieces? Why?
- What wouldn't be a good number of pieces? Why?
- How many different ways could you arrange 12/15/16/17/18/24 pieces? (Opportunities for differentiation here) Which ways would be easiest to package? Why?
- If you wanted to share chocolate with 3 friends, what number of pieces would be good? Show an array that would be easy to share between you and 3 of your friends. (Number of friends could be changed to make this more or less challenging.)
- Which numbers can only be arranged in a strip one piece wide? Would these bars be good for sharing? Why not?
- What kind of numbers make a square array (where both sides are the same)? How good are these for sharing?
- If I wanted everyone in the class to have one piece of chocolate, what bars would I need to buy?

At the end of the (series of) lesson(s), there is always eating the chocolate, which even in these days of healthy eating can be done under the heading of 'everything in moderation'.

Chocolate is also good for working with fractions. There is a very good lesson 'Chocolate to share' in Let's think through maths 6-9, published by NferNelson.

Royal Borough of Windsor and Maidenhead

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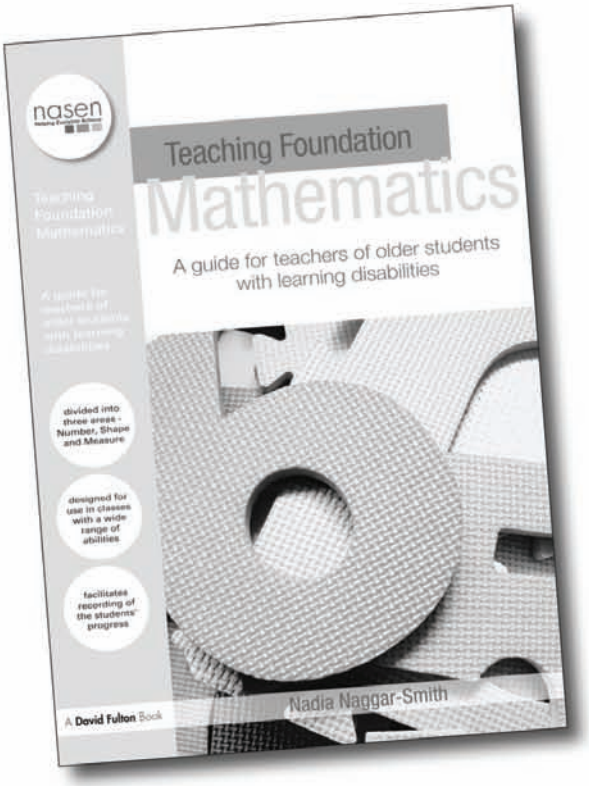

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