Equals

Realising potential in mathematics for all

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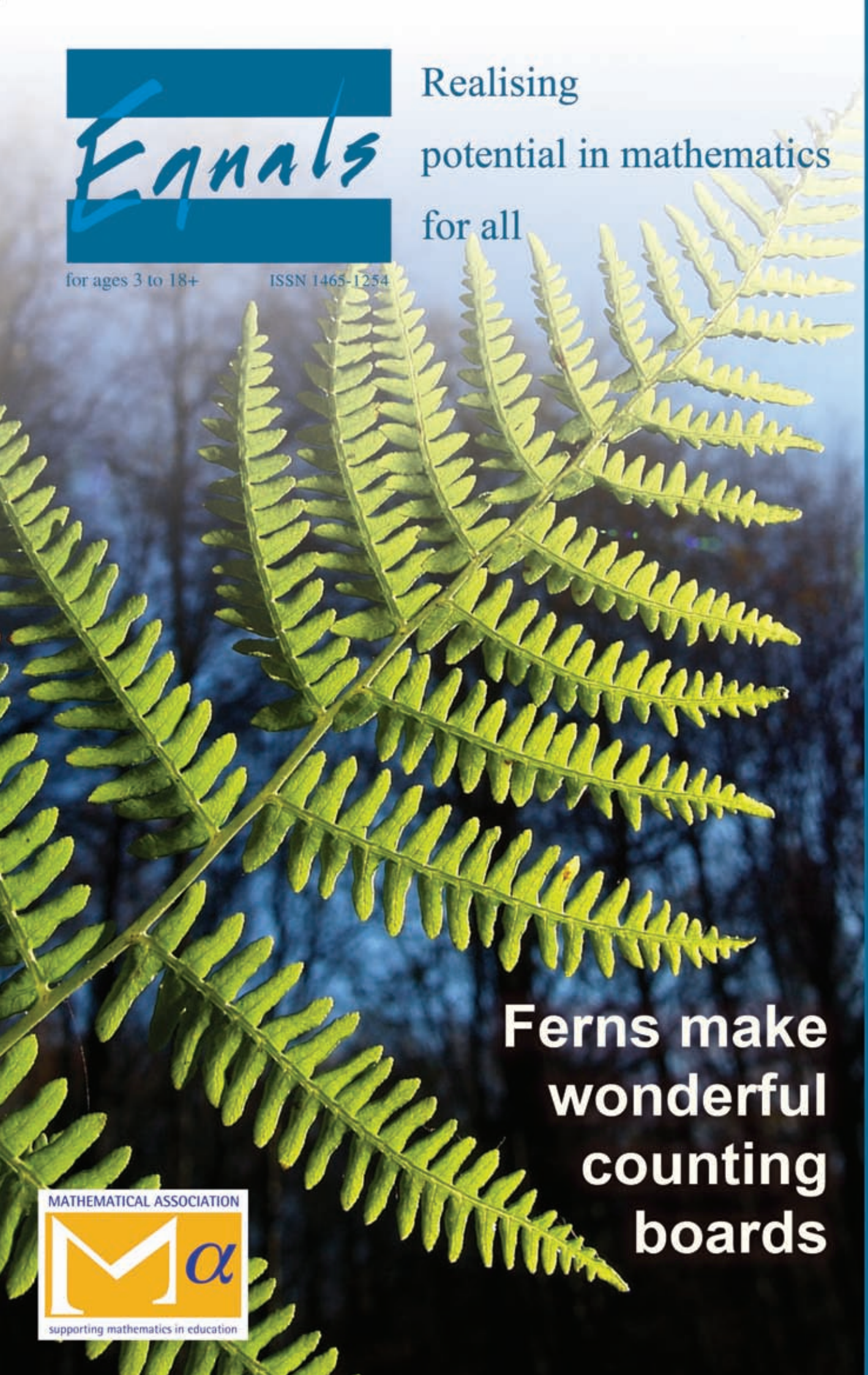

Ferns make wonderful counting boards

MATHEMATICAL ASSOCIATION
supporting mathematics in education

Equals

Realising potential in mathematics for all

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Designed by Nicole Lane

Editors' Page

Colin Richards, writing in the *TES* of 23rd November, warns that the government's latest plans for the primary curriculum may force the sacrifice of the "liberal humane values of primary education to the soulless bottom line of the politicians" who, he maintains, have a narrow, impoverished view of achievement. For years the education of the lower achievers in our schools has been severely damaged by the testing system. Mathematics is a subject wide open to rote learning without understanding and approaches based on drill and practice can quickly kill any interest or excitement in the world of numbers or shapes or of logical puzzles. Because of these deadening trends we are presenting in this issue the first of a series of studies of outstanding teachers of the past who have, often against the odds, opened up the world of exploratory learning to their pupils. Our favourite phrase of Sylvia Ashton Warner is "tidiness kills education". To reiterate what is said elsewhere in this issue: once you have a class of more than one child you have a mixed achievement class and should act accordingly.

Education in this country today has been dumbed down, chiefly because of the meddling of politicians. As far as work in the field of number is concerned, the fear of the effect of calculators in the classroom has, because of the ignorance of those politicians, once again raised its ugly head. Yet, used in the right way, how enlightening a calculator can be. I can remember many years ago being asked by a child at a conference for pupils "What is the result of dividing 0.5 by 2?" My answer: "Put 0.5 in the calculator, divide it by 2 and see what you get." We looked at the result and discussed it in relation to dividing 50, 5 and 500 by 2. A very brief episode but one in which enlightenment dawned concerning place value and decimal notation. Division, especially the long sort, often seems to cause trouble so we have included the whole of Alice Onion's research piece in this issue although it much exceeds our usual article length. This makes it easier to make a hardcopy of it for reference in a school.

We have as our centrespread in this issue a copy of a double page from the latest *Circa Maths Magazine* in memory of Charles Snape who has just died. Charles, as you can see from these pages, did much to present mathematics in visually exciting ways. I have in my mind a vivid picture of a friend who was visiting me recently sitting with his five year old daughter on his knee both lost in the working out of some of the puzzles from the latest copy of *Buzz,* another of Charles's publications. His influence on the SMILE materials was considerable and the majority of those are now available to all on line at the National STEM Centre at the University of York for free. All these activities were originally written by teachers for their own pupils. We would recommend a visit to the STEM Centre with its store of very high quality material all of which is tried and tested and has proved successful in the classroom.

Supporting mathematics in special schools

A few years back Joe Murray took on responsibility for supporting Key Stage 3 mathematics in special schools in two large Local Authorities.

The role was a real challenge but extremely satisfying and one which has remained with me well into retirement. What began as a termly network for mathematics leaders evolved into regular in-school CPD for all staff and a series of regional conferences for teachers and teacher educators in a wide range of SEN settings.

My first point of call with the special school mathematics lead teachers was to establish their own needs and their students' needs. I had some ideas of my own [more later] but I was not surprised, though a little deflated, to hear the old chestnut, "basic number skills.....number bonds" offered as priorities. I pictured children who will have met such objectives many times and, despite this, teachers were not able to look beyond and offer challenge, stimulus....and even some fun! Basic number seemed to be stuck around addition/ subtraction bonds and multiplicative bonds were out altogether for many.

The primary-age children seemed well catered for with many number songs and rhymes but I wanted some age-related activities for the secondary learners. In the longer term, I hoped that we might challenge our children to see patterns, make predictions....and even offer a few simple generalisations.

In the longer term, I hoped that we might challenge our children to see patterns, make predictions....and even offer a few simple generalisations.

The easiest and quickest way to start was with counting....or rather with number word sequences. Some teachers found this a good tool for assessing children's knowledge of number names and the correct sequence but these were few and most soon branched out into more challenging ideas. One of these was counting in different steps. At first we started at zero and counting up in twos, then threes....then bigger steps. Careful questioning led to some children seeing patterns and building simple ideas of multiplication tables. Others worked on a visual approach with interlocking cubes.

The work progressed to starting at numbers other than zero, starting from a higher number and counting down.... first in ones then in higher steps. Those "basic number skills" were indeed being addressed but with more challenge and opportunities for teachers to open up new avenues of learning.

One such pathway was in a lesson I helped to support. We decided to use the idea of a number chain to address some simple objectives but the activity would also offer opportunity for process [functional] skills at the appropriate level. We were confident that the pupils could easily access the objectives of knowing odd and even numbers, adding 1 and halving small even numbers. Most

children in the lesson were behaviourally challenged and engagement was often the critical factor. What followed surprised and delighted me and the teachers involved.

We explained to the children the rules for making the chain by asking them to choose a number below 20 to start. If their number was an odd number they should add 1; if it was even they should halve it. They should do this with each new number they made. I modelled this using number 9 as the start number. This gave us 9 10 5 6 3 4 2 and 1. I asked the children to work in pairs and see who could find the longest chain.

First responses offered the simple generalisation that every chain finished at 1. Children were spotting that chains were different lengths and some even numbers were bad ones to choose for long chains. They soon began trying higher numbers to start with.....and even longer chains emerged. Children were surprised to find that larger numbers did not always make the longest chains.

Finally we came to the plenary where we would find who had the longest chain. The teacher warned me at this point that there were some very competitive boys who always liked to win.....and often reacted badly if they did not win. When I was offered a long chain using 37 as the start, I asked if anyone could find a longer chain. I noticed one of these boys half raising his hand and clearly thinking. I asked if he had a longer chain and he said he thought so.

"I would start with 74", he said. "That would make a longer chain".

I asked how he could be sure and he replied, "Well. If I double her 37 to make 74 and start with that, mine will go 74...37...and then I will get all her numbers and one extra".

The teacher warned me at this point that there were some very competitive boys who always liked to win.....and often reacted badly if they did not win.

He sat back with his chest puffed out enjoying the acclaim of his nearby peers. One of these then asked if I would allow start numbers above 100. I said I would and he stated confidently that 148 would make an even longer chain. Some days later the teacher rang me to say the class had concluded that there is no longest chain; you can always make a longer one.

Special learners do count.....and a whole lot more too!!!

Joe Murray
ATM General Council member
Retired mathematics consultant

60% of Mumbai's population are slum dwellers.

800 million to 900 million – the number of squatters on the planet.

48,510 homelessness applications accepted in the UK in 2011.

In Rio people spend 30 years transforming homes from mud to concrete.

A tenth of the world's population are squatters.

930,000 – the number of empty homes in the UK.

Guardian G2 04.12.12

Long division: the roadblock

Some findings and analyses are drawn by **Alice Onion** from the early stage of her MPhil research into women's experiences of learning mathematics.

I am about one third of the way though collecting data (six participants out of about 18 perhaps). The first three participants were interviewed individually and they are relatives of mine, my mother, my sister and my niece. The other three were interviewed as a group. They are all mothers of children in one primary school and the interview took place in the school. Interviews were video-recorded. I am transcribing and analysing them in sequence. At this stage I have analysed the first three and have just started on the group interview.

My target group for these explorations is women who did not do well in mathematics at school, hence the idea of reporting some findings in *Equals*. In addition these women did not achieve highly in education more generally. Culturally they would be described as 'working class' and ethnically as white English. In the interviews, questions were very open - people were asked to talk about their experiences of mathematics without being steered towards any particular topics.

Long division is one of the topics that has emerged during the interviews. This article draws on three of the participants, one from the group interview and two who were interviewed individually. I begin with relevant extracts from the transcripts of the interview. These are records of talking and hence they are not easy to read. I advise readers to take them slowly, listening for the participants' voices. Before writing this article I have analysed each transcript extract fully. From these analyses I have identified themes: long division characteristics, teaching, and feelings. I report on these three themes after the transcript extracts and I finish with conclusions.

Extracts from transcripts

Susie (not her real name)

Susie was one of three participants in a group interview. She talks about long division on three occasions in the interview. Her mention of if begins when the three participants are talking generally about mathematics as a frustrating subject. J stands for Jessie, one of the other participants in the group interview.

22 S: I was sitting in the classroom and long division came in. And that was like, "What? I'm sorry what? I don't-"

23 - and it was just really the way it was being explained (second pause). I could not - .

24 And I kept thinking, "This should make sense." It should make sense.

25 J: It was expected to make sense, wasn't?

26 S: Ye' and it - . I remember the teacher being "da-da-da this way" [board writing gesture with hand]

27 And it was like – It was like I imagine a really severely dyslexic person feels if

somebody is demanding that you should be able to read that.

28 J: [talking at the same time as Susie] Ye'. I can relate to that. [unclear what she is saying] go blind ye'

29 S: Couldn't get it at all and that's when I remember I started to feel frustrated with maths.

The second time Susie mentions long division she is talking about how the school currently works with children.

66 S: It doesn't really matter if you do this sum this way or that way, as long as you can figure it

67 out how your brain works. I just want to think, "Why, why was that – that principle would

68 probably have just worked for me as a child. Just "OK yes this is long division, ye' that's not

69 making sense to you. Why don't we try break it up and doing it this way?"

70 No, you had to do this formula. "This is how we do long division" [board writing gesture]

71 And even now it stresses me. Couldn't – percentages. Couldn't do a percentage if I tried.

72 Because I had to - . you had to do it [gesture of sequential layout] this way.

73 And it's very frustrating.

The final mention continues with the theme of current children in the school and again links back to her own experience as a child.

245 S: …… if we can help our children to understand, even if you didn't

246 understand this particular equation, that doesn't mean you're stupid. It doesn't mean

247 you're never going to be able to do maths; it means you're struggling with that equation,

248 let's try and find another way of you understanding that. If we can break things down I

249 think like I say, I know that from primary school that's when it started to go wrong with me.

250 As soon as I couldn't understand, I can picture the board and everything. As soon as I hit

251 that roadblock with that long division [unclear] well I thought I knew that I thought I

252 could do this. I'd been able to do the adding up and the multiplying. I don't know [it / I]

253 went to pot then. I think, I don't think people then, thought, were so into building up a

254 child's confidence and seeing what an effect it could have. And not being, you know,

255 but to feel that this doesn't make sense, because I was told yesterday that my maths work

256 was good, but with this I can't even, I can't even begin to do this equation – gobbledegook

Lucille (my sister)

Lucille started talking before the camera was turned on. The first recorded utterances I have from her are:

1. I'm no good at maths, never was.
2. I never paid any attention. I couldn't do it
3. Couldn't do long division
4. Primary school wasn't too bad. Learning your times tables wasn't too bad, adding up, taking away, but long division – no 2 (second pause) never got the hang of it.
5. And I think in schools then they didn't really help you. You know, if you was, couldn't do it, they just left you alone.
6. If they'd given you a bit of extra or made it a bit more interesting then maybe I'd have learned a bit more.

Later in the interview, when Lucille had been telling me about other lessons, I asked: "Do you remember the long division lesson where you didn't get it?" She replied:

7. "I remember the teacher doing it on the blackboard and by the time she'd finished she'd lost me at the first bit." [laughing as she finishes talking]

Angela (my niece)

Early in the interview Angela talked about writing the mathematics down and her view that her work was not neat enough. She told me she had two books to write in for mathematics, one for rough working out and another, with squared grid pages that was to be handed into the teacher to be marked. But Angela did her all working in the book with squared paper.

> "And that's what I used to get into trouble for, for not doing my working out in the other book."
>
> "And obviously I wasn't very neat. It has to be neat doesn't it? They give you graph paper for a reason. My numbers didn't even fit in the squares."

Later in the interview Angela returns to the theme of not being neat and this is where she mentions long division.

> "And I remember we used to do long division. I'd start there and it used to be that big [hand gestures] because my numbers get bigger as I went down the page, and that's why I used to get in trouble. Most people would have ten on one page and I was like two on one page."

Analysis

Long division stands out as a specific procedure and one that is not comfortable for these three participants. For each of them there is memory of a critical incident involving long division. The memory is accompanied by visualisation, typical of the emotionally charged events that are referred to as critical incidents. Susie tells us in the present tense "I can picture the board and everything". Both Susie and Angela accompany their talking about long division with hand gestures indicating in Susie's case the teacher writing on the blackboard and in Angela's case the pupils' work in exercise books. These specific hand gestures add weight to the evidence of visual memory and of the critical nature of these long division incidents.

Long division characteristics

There are several features of long division that emerge from these three women's accounts. The stated memories describe a procedure that is long,

complicated, hard to understand and inflexible. Long division also seems to have a special place of power within the mathematical journey for at least two of these women.

All three women give us a sense of how lengthy the procedure of long division is. This somewhat banal tautology is worth looking at briefly. Even Angela, who voices no problem with executing the procedure, tells us that she was unable to set her long division calculations out properly in the way the teacher required and she got into trouble as a consequence. Lucille gives us the clearest indication of how long the procedure is when she says the phrases "by the time she'd finished…" and "the first bit…". Susie also refers to a beginning: "can't even begin to do it…". Linked to this length for Lucille and Susie is the fact that from the start to the end the procedure is incomprehensible; it doesn't make sense. For Susie this shatters her expectations that maths should make sense, repeating the phrase "This should make sense. It should make sense." And telling us later that long division is "gobbledegook".

Another feature of long division that comes across is how rigid and inflexible it is. In Susie's voice the inflexibility of long division is couched in the negative; it is contrasted with a positive imaginary scenario where there is more flexibility. This is the contrast between the "No, you had to do this formula" in line 70, with the positive "OK, Yes, this is long division, ye'…." In line 68.

The power of long division comes across from what Lucille and Susie tell us. For Lucille it is the first topic mentioned and there it is directly linked to her being "no good at maths". Susie uses powerful language when she talks about the consequences of her encounter with long division. It marked the beginning of her frustration with mathematics. It was a "roadblock" denying her access to potential future learning so that after that encounter things "…went to pot…". Perhaps for Lucille too, long division marks the point where she stopped learning mathematics.

It was a "roadblock" denying her access to potential future learning so that after that encounter things "… went to pot…".

Teaching

In both Susie's and Lucille's accounts we see an active teacher demonstrating the long division procedure on the board. In both cases we see the teacher as the agent responsible for Susie and Lucille not understanding long division. Susie refers to the way it was explained and Lucille to the teacher losing her. It is hard to tell here whether these are clear cut allocations of cause, or whether, more likely, they are also projections of responsibility onto the teacher in order to protect the subject from negative self-judgement, an idea that we return to later when we consider the feelings involved in these anecdotes.

In accounts from both Susie and Lucille the word 'help' appears. Both of them appear to be contrasting their experience as pupils with what they perceive schools are like 'now' as opposed to then. Both the accounts also link this lack of help to a 'what if' scenario. What I hear is that, if they had been helped, if the work had been interesting, if they had not been left alone, if the explanation had been better, if they had been shown another way

of doing it, then perhaps things would have been better for them, perhaps they would have been able to do and understand long division. Susie gives us a clear sense of what a positive experience helpful teaching would be.

Angela gives us a sense of the teacher's expectations about neatness, but we do not see an active teacher, demonstrating the procedure as we do in the other two accounts. We do however hear that, in the context of long division, failure to comply with the teacher's requirements for neatness did get Angela into 'trouble'.

In all three accounts, the view by pupil of teacher is not comfortable. The pupil sees the teacher at best as unhelpful and at worst causing the pupil to be in trouble. So perhaps we can site some erosion of pupil's trust of the teacher in the long division lesson. It may of course be a collapse of trust rather than merely an erosion. Such a collapse might account for the episodes being remembered as critical incidents.

She uses the phrase "severely dyslexic", not just dyslexic to describe how she felt.

Feelings

Susie's account is the most emotional of the three. She begins with incredulity, repeating the word "what" in line 22. This places the problem out there with the incomprehensible nature of long division and not in Susie herself. But later in the metaphor of dyslexia we see Susie suggests that the feeling she had was of being disabled. She uses the phrase "severely dyslexic", not just dyslexic, to describe how she felt. She felt that a literally impossible demand was being made of her, because she felt incapable of doing long division. She was made to feel stupid and incapable not just of doing long division but of being able to do mathematics at all (lines 246, 247). She tells us that long division is where her frustration with mathematics began. She does not tell us where that frustration ends, except to say that, "even now it stresses me.

One of Susie's feelings that is shared with the other two researchees is that of exclusion. When the remembered teacher says, "This is how we do long division", Susie becomes excluded from the community of those who do long division. From Lucille we get a sadder sense of not being included, a sense of abandonment, when she tells us, "They just left you alone." Angela was not included in the group of pupils who could set their long division calculations out properly. She tells us that "Most people would have ten on one page and I was like two on one page".

Both Susie and Lucille show elements of defending themselves from the negative/pejorative judgements implied by their failure to understand or do long division. These defences are evident right from the beginning of their utterances. Lucille says she did not pay attention and Susie blames the explanation provided by the teacher. Lucille also says the teacher loses her at the first bit, again this seems to be the teacher's fault, hence sidesteps any blame that Lucille might attach to herself. She also laughs it off when she is talking about not understanding the teacher's demonstration of long division on the blackboard; laughing is a classic defensive behaviour used to mask uncomfortable feelings. The main defence in both cases is to hold the teaching responsible for the failure in

understanding, rather than any innate inability (like severe dyslexia) or stupidity (Susie line 246).

Lucille and Susie contrast the teaching responsible for these adverse outcomes with what might have been, and perhaps with how things are now for children, as they see it. In the utterances where Lucille and Susie contrast the teaching of long division they experienced as children with how it might have been, or how they imagine or believe it to be for children today, we hear great disappointment and regret. If only Lucille had been helped and not "left alone"; if only she had been given a "bit extra" or if long division had been made more interesting. If only Susie had been helped and been reassured that there were other possible ways of explaining long division, or other methods for completing the calculation. These 'if onlys' give us a sad wistful look at the past, and now, in the interview, the participants imagine how different, and how much more positive, it could have been for them.

Conclusions

From Lucille and Susie's descriptions of failing to learn long division we can conclude that teaching is not the same as learning. If the teacher demonstrates a procedure on the board, it does not guarantee that the children watching and listening will be able to replicate the procedure, let alone understand it. Although from only two participants, we can tentatively suggest that what is needed is a more flexible approach where long division can perhaps be explained in other ways, perhaps broken down into smaller steps, or in some way made more interesting. Above all, that the focus in the classroom should be on the learning; that children should not be "left alone" or made to feel stupid. The need for help should be recognised and suitable help given. The risks of not doing so include a cessation of a child learning mathemaics from that point onwards.

Above all, the focus in the classroom should be on the learning; that children should not be "left alone" or made to feel stupid.

Of course it might be that we should not be looking to find ways to make the learning of long division more effective. The messages about effective teaching that emerge from this 'study' are applicable to other topics. Long division, as with any topic, must justify its place in the curriculum. Even if included, it may be that the conceptual demands are not well suited to leaners in primary school. The concepts used in long division may require a better foundation in multiplicative reasoning than is typical of children in primary school.

It would not be too strong a conclusion to suggest that these long division lessons have caused emotional damage to children, something indefensible. Furthermore we can see for one participant that her experience of long division denied her access to mathematics from that point on. Given that the aim of teaching is to facilitate children's learning, this is a hugely devastating unintended consequence. It might suggest that long division is simply too high risk for children at primary school, and is best left to later, or not taught at all.

A final conclusion stems from Angela's story. Angela was left with a belief that neatness matters, and perhaps matters more than content. We see no pride from her about her ability to do long division calculations, a procedure we know that others find

impossible. What we hear about is her getting into trouble for it not being neat enough. It seems perverse to me that a child should be 'in trouble' for their work when the mathematics is OK. This comes back to the conclusion that the focus should be on the learning. Angela had demonstrated that she had learnt the procedure, but her success does not appear to be an important feature in her memory of long division.

Alice J Onion
Visiting Senior Research Fellow
King's College London

We're all in this together: in praise of mixed achievement groups

The phrase "We're all in this together", writes Rachel Gibbons, rings false, when used by the Prime Minister and his millionaire colleagues in the Cabinet while more and more of the rest of us are finding it hard to make

However, in education circles even Sir Michael Wilshaw accepts children "all in it together" provided teachers have appropriate materials to put before so called "mixed achievement groups". Indeed, surely all classes comprising more than one child are mixed achievement groups? Indeed they also exhibit a wide variety of attention spans, learning style, paces and interests. This is true surely, as I have argued many times before, even if schools practise setting or streaming. This means therefore, I would maintain, that any attempts to get a whole class to progress together is doomed to failure. Joint activities are of course possible and indeed desirable – mathematics needs to be discussed.

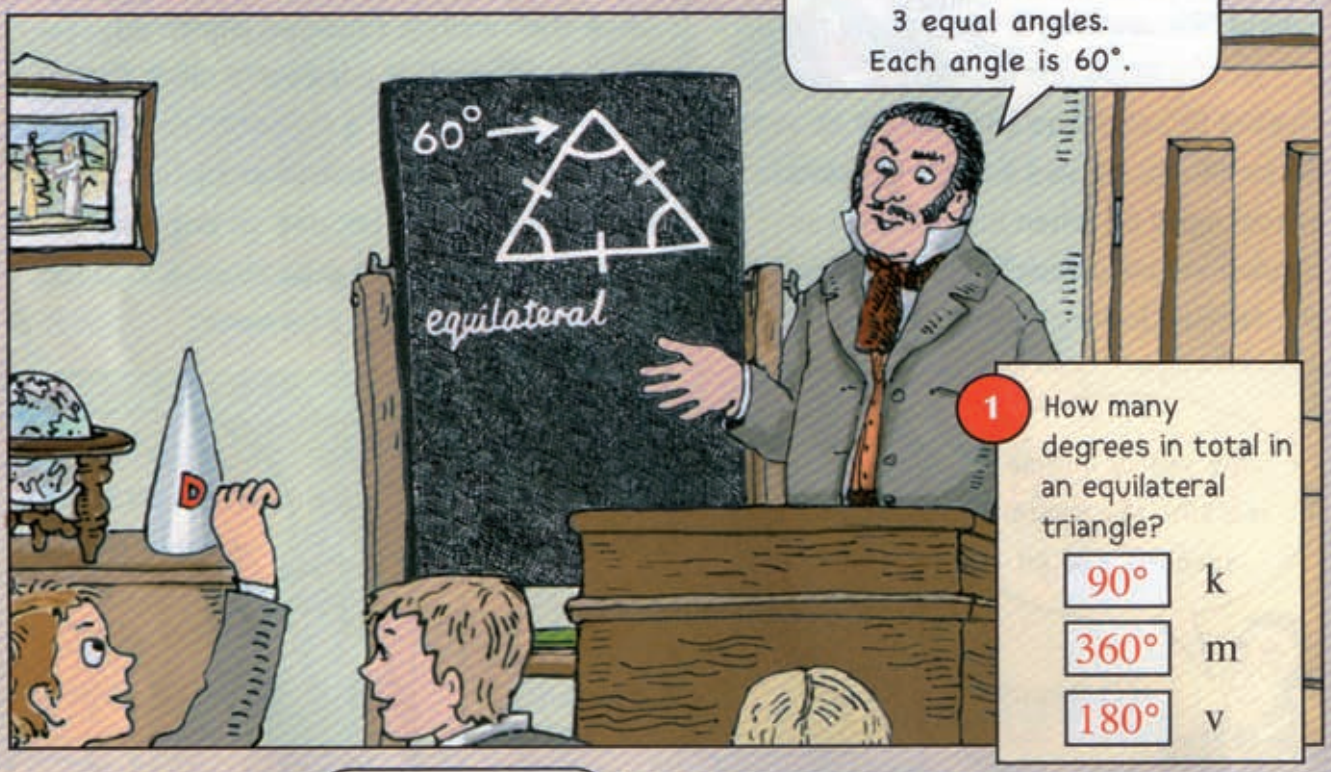
The National STEM Centre at the University of York has among its archives, all ready for the use of anyone who cares to visit it on line, many rich mathematical resources including most of the SMILE materials produced back in the 1970s and 80s (as many of you will know) by a group of teachers in the ILEA (Inner London Education Authority). Those teachers, of whom I was one, were given the privilege of writing mathematical activities to use in their own classrooms and sharing these resources with each other, copies of the results being produced for them by the Local Authority. All members of this group grew and developed their expertise remarkably through the experience of writing and then editing, discussing and refining the mathematical activities they wrote for their own pupils, sometimes for one particular pupil. Such attention to detail is bound to increase interest and achievement.

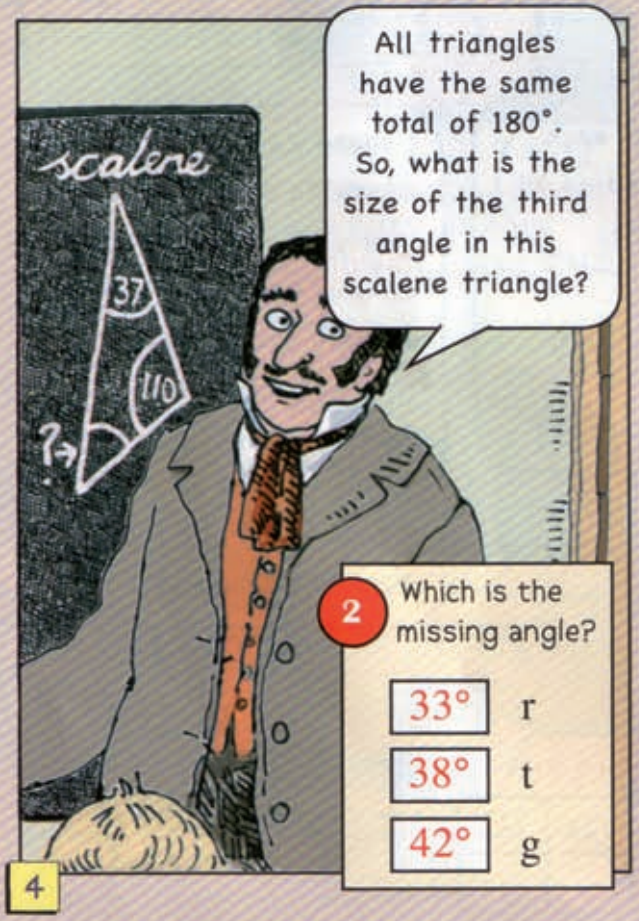
These resources are now revered by the mathematics education community and I would recommend them to you for study and where appropriate for use in your own classroom. They were written by practising teachers for use with their own pupils and went through a rigorous editing process.

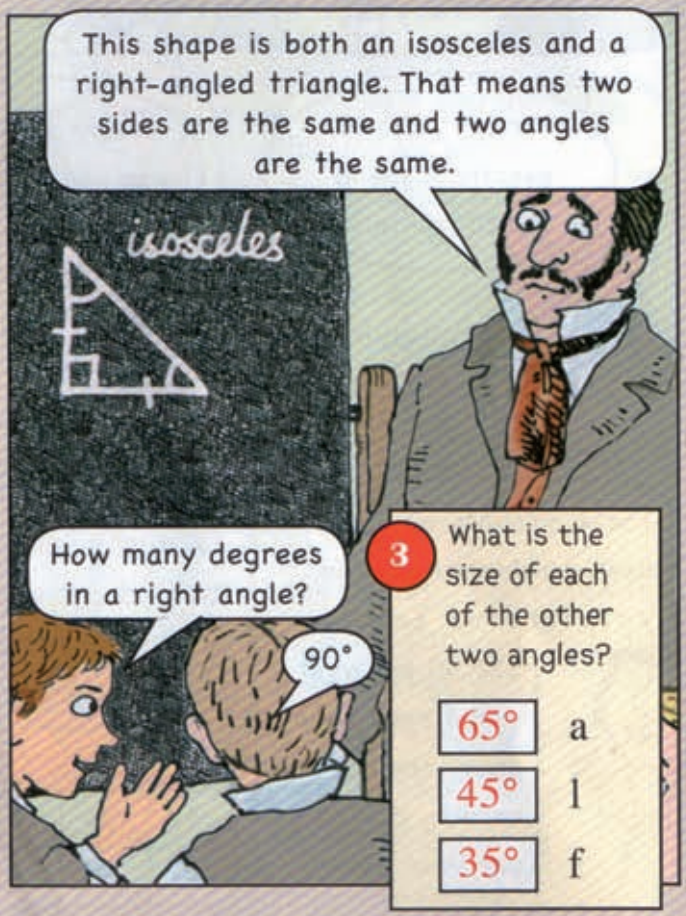
Rachel Gibbons is a retired inspector for mathematics, ILEA

In Charles Dickens's time school children worked on slates because paper was too expensive. Work through this Victorian lesson and you will know your angles.

Shapes on slates







4

How can you use what you know about triangles to work out the sum of the angles in a quadrilateral?

quadrilateral

If you join opposite corners you make two triangles.

Yes, I see.

4 What is the sum of the internal angles in any quadrilateral?

240°	w
180°	u
360°	i

David draws on his slate ...

I can divide a pentagon into triangles ...

Good, Master Copperfield. Make sure that lines don't cross.

5 How many triangles did David draw in the pentagon?

4	p
3	o
5	d

Despite talking too much, Master Copperfield has discovered you can use triangles to work out the total sum of the angles in any polygon.

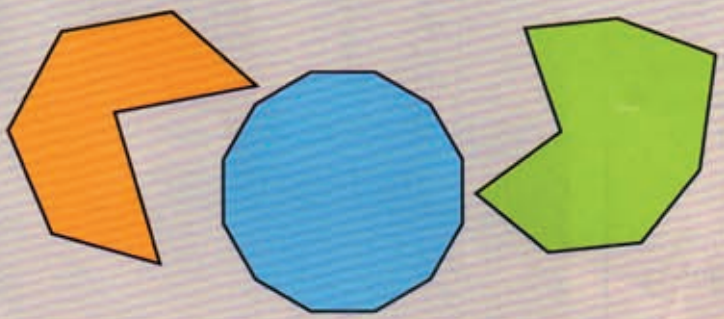
Is a polygon an empty parrot cage?

Don't be daft. A polygon is a closed shape with straight lines.

6 How many triangles fit inside a hexagon?

6	h
5	q
4	e

Is the number of triangles in a polygon always 2 less than the number of its sides?



Put the letters by the correct answers to spell out a Dickens character.

Solution Checker

(5)	(3)	(4)	(1)	(6)	(2)

Behaviour management in mathematics

Excerpts from **Jennifer Pendlebury's** findings in her mathematics research project remind us of classroom ground rules.

The researcher has completed two placements. The first placement, a school where there were minimal behavioural issues and the second, a school that had a number of behaviour problems. During these placements the researcher became interested in different behavioural management strategies and set effective behaviour management as a personal target.

When adolescents say something is boring they are often expressing a low level of anger and frustration which can disrupt lessons.

Within schools there are well behaved pupils and pupils that misbehave and cause disruption. Low level disruption can occur within mathematics lessons because some pupils may have a negative attitude towards mathematics. When adolescents say something is boring they are often expressing a low level of anger and frustration which can disrupt lessons. This can be done in a number of ways, such as turning up late for class, swearing or being intimidating or verbally abusive to other students.

it is clear that there are three important components identified that form an effective and efficient behaviour management programme for reducing disruption in mathematics lessons

There are many components that contribute to effective and efficient behaviour management strategies for reducing disruptions within mathematics lessons. These are aspects such as effective planning, the prompt arrival of the teacher and the pupils, effective and engaging starters and plenaries, the maintaining of pace, effective questioning skills, classroom rules, reprimands and punishments and the teacher's attitude. A crucial aspect that contributes to good behaviour management strategies is thorough planning to meet the learner's needs. If a learner is actively engaged within a lesson and working through activities that meet their learning needs the chance of disruptions occurring within lessons is reduced.

Through analysing the lesson plans formed during the study, the observations carried out by the class teacher and the self evaluations by the researcher, it is clear that there are three important components identified that form an effective and efficient behaviour management programme for reducing disruption in mathematics lessons. The three components are effective and personalised lesson planning, forming a good relationship with the pupils and maintaining a relaxed and friendly atmosphere during each lesson.

Jennifer Pendlebury is doing research at Edge Hill University

Tales from the ARC: 1

This issue of *Equals* sees the start of a regular feature 'Tales from the ARC'. These stories will relate the true mathematical adventures of 'Ken' our new columnist who works at The Academy, somewhere in the North of England.

September 2012, after 24 months working full time as a primary teacher, found me re-starting my career as a mathematics teacher in a challenging secondary school not far from home. "Ken, the school is struggling to find three mathematics teachers, could you help?" said my friend Les who had just taken over the headship of this inner city school which we shall call 'The Academy'.

At the start of this career move my initial thought was: "It's only 15 minutes away and Sally, my youngest, in Year 4, won't have to leave the house at 7.15 any more!" Having to get her up so early every morning was beginning to impact upon her health (headaches) and her school work - so the chance to stay close to home and support her was one I could not turn down.

My two years in the primary phase had prepared me well, many of my KS 3 pupils were working at Levels 3 and 4, and I felt more than ready to motivate the pupils to engage with the subject, becoming mathematical thinkers in the process. I soon found, to my cost, that the main issue was their attitude to learning. Many pupils had had a succession of supply teachers so consequently their mathematical confidence was fragile. I began to use the *Let's Think through Maths* resources (formerly known as CAME) to engage them in a way that required little prior curricular knowledge. I had been introduced to them by a consultant in Cumbria some 15 years ago and had used them regularly over the years, especially for lesson observations. I was also fortunate to come across the KS 1 and 2 versions during a spell as a PPA cover teacher in a primary school in 2008.

Each mathematics activity in the *Let's Think* approach begins with an everyday context, one that can quickly engage the pupils in exploring mathematics that often introduce ideas at levels 5 or 6. The lesson I used to introduce the pupils to some work on angles was called *Robots* and it was during this activity that I noticed Kathy watching the pupils with interest. Like me Kathy was also new to the school but her role was far more challenging than mine. She is in sole charge (well supported by two assistants) of the ARC pupils. The ARC is an internal unit where the schools 18 MLD pupils spend each school day. A school within The Academy, the ARC is a peaceful and safe place. When I learned that the pupils were following a KS 1 curriculum for literacy and mathematics my admiration for Kathy soared.

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My involvement in the ARC further developed as I spent time with three of the pupils designing a Rangoli pattern to support my display work. Working adjacent to the ARC has resulted in many conversations regarding the mathematics provision for these pupils. Kathy was very open and honest in sharing her frustrations about how to support 15 and 16 year old pupils with a diet of Year 2 resources that she felt were too immature in context for them. Her own literacy background meant she felt able to support this core area but not mathematics.

Towards the end of our first half term I remembered the KS 1 *Let's Think* resources in the loft. I suggested to Kathy that, because of their engaging contexts, they might help her team gain a sense of where their pupils were and that such knowledge could be used to plan a course of mathematics instruction to support this vulnerable group of learners better. And so reader, this column will relate my adventures with the 18 adolescents in the ARC. I will share the lessons I plan and the resources I use to support a group of young adults working towards Level 2. The activity I plan for next week is called *Seeing Numbers* and I chose this because one of Kathy's teaching assistants expressed frustration in trying to help one of her weakest charges to recognise numbers beyond 10! I decided to start here as the lesson requires no numeral recognition and my hope is that the activity will build upon the pupils' natural ability to subitise enabling them to see groups of 3 or 4 objects within a larger collection.

Yours,
Ken

Great teachers: Sylvia Ashton Warner

Scenes from Ashton **Warner's** infant classroom.

Sylvia Ashton Warner 1908-1984
Tidiness kills education

In the earlier part of the 20th century, infants in New Zealand were expected to learn to read from *Janet and John* books imported from Great Britain, but the majority of Sylvia Ashton Warner's infant class were Maoris. Fortunately for them Warner recognised the complete inappropriateness of this material and started to write – and illustrate - small books especially for them based on their own Maori culture. Asking them for their lists of significant words sometimes gave surprising revelations of the brutality of their experiences of life. In her native New Zealand, Warner's revolutionary vision of education went largely unrecognised, but when she retired she travelled widely lecturing on her methods and her genius was recognised in North America and in Europe. The exception in her native land was an inspector who visited her classroom. He recognised the exciting teaching and learning going on in Warner's classroom and

The expansion of a child's mind can be a beautiful growth. And in beauty are included the qualities of equilibrium, harmony and rest.

provided her with a marvellous typewriter that produced "infant-room-printing" for her to use in the production of the books she wrote and illustrated for her class. These enabled her to meet each child's individual needs and interests.

Warner writes of organic reading and creative writing. By this she means instead of starting with the shortest simplest words – "the cat sat on the mat" type sentences – reading and writing should start where the children are with words familiar to them in their everyday lives like "crying", "kissing".

> "They read them and spell them for ten minutes. I don't require they should all be remembered. If they are important enough they will stay all right, whatever the length. Neither is it for me to sort out which is important. I never say "Spell pictures." I say, "Perri, spell one of your words." Then I get the real word and the right spelling.
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> This is the main reading of the day. They master their own first, then tackle someone else's."

If she had been teaching today she would have recognised setting and streaming as the con-jobs they are, introduced to enable teachers to pretend that their classes are made up of pupils with similar needs, interests, paces and patterns of learning, whereas, of course - as she realised only too well – once you have more than one child in front of you, you have a mixed achievement class.

If we are to visualise her classroom and the children more vividly, we shall do well to reflect on her own words.

She writes about the characteristics of her Maori pupils:

> "with no opportunity for creativity they may well develop, as they did in the past, with fighting as their ideal in life. Yet all this can be expelled through the creative vent, and the more violent the boy the more I see that he creates, and when he kicks the others with his big boots, treads on fingers on the mat or throws a stone, I put clay in his hands, or chalk.
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> "Noise, noise, noise, noise," says Sylvia Ashton Warner. "But if you don't like noise don't be a teacher. Because children are noisy animals and these in particular, the young of a New Race, the noisiest I have ever known."
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> "And I go on trying to find out how to teach. I plan so carefully, so fully prepare, meaning to forestall failure but so often it falls through. I've got the desks in a single half moon round the long room with an open area in the middle like a Maori marae (an area in front of Maori meeting house where speeches are given) with me strutting round like the Maori chief. They look so pretty all sitting there in this orderly half circle. Their black heads over their books . . . or not. To see it is to think it's a lovely school and I an excellent teacher, but I do not rear easily wear the uniform of the supreme commander for I am not that at heart, though I need to be. After all somebody's got to be in control; that's what I'm paid for."

"I'm tired these evenings. There has been an influx of five-year-old Maori boys. Only infant mistresses who have handled these know why I am tired these evenings. Their boots weigh a ton each, their attention span is about ten minutes, their voices are like wild bulls and to teach them is a simply fantastic performance.

With all this in mind I try to bring as many facets of teaching into the creative vent as possible organic moulds.

I like to know where each child is and what he can do, and I like the knowing. I'm here to know and I see that I know where each one is.

The expansion of a child's mind can be a beautiful growth. And in beauty are included the qualities of equilibrium, harmony and rest. There's no more comely word than "rest". All the movement in life, and out of it too, is towards a condition of rest.

Many centuries ago Plato and Pythagoras had already found in number the clue to the nature of the universe and to the mystery of beauty. . . The golden Section is the ideal proportion . . . It cannot be explained in an infant room. It can be felt all right and it can be drawn easily and every day. . . Ferns make wonderful counting boards. . . The laws of number, nature and beauty turn out to be much the same thing."

Reviews - Mary Clark

Thinking for Ourselves
Jill Mansergh and Margaret Jones
Association of Teachers of Mathematics, 2007

ISBN 978-1-898611-46-2

This book provides a variety of contexts in which children are encouraged to think for themselves. The content of the activities is intended for pupils working within levels 1 to 5 of the National Curriculum. It is organised into three sections, each with its own very distinct character:

Section 1 - Questions to promote mathematical thinking skills

relates closely to an earlier Association of Teachers of Mathematics (ATM) publication *Thinkers – a collection of activities to promote mathematical thinking*. This publication was mainly aimed at an older / more able group of pupils than the present publication. This first section encourages pupils to engage in thinking about mathematical statements in a variety of situations, to respond with their own thoughts and ideas and provide reasons for their responses. The authors describe the statements as quite often being ambiguous or giving rise to a number of different answers. Pupils' responses can be used to provide assessment information about the understanding of particular concepts, as well as showing how powerfully children can think about mathematics.

Activities are sorted under headings of 'Number', 'Shape and Space' and 'Handling data' under each of the following focuses:

- Give me an example of … and another … and another …
- Hard and easy
- The same and different
- Odd one out
- Additional conditions. Give me an answer … then
- Always, sometimes, never true
- Sorting
- Equivalent statements
- Burying the bone
- Lists
- Ordering
- Find the correct solution
- Agree or disagree
- Tell me more.

Section 2 – Activities to promote mathematical thinking skills

is a collection of longer activities intended to last for at least a lesson. Guidance for teachers emphasises the importance of allowing children to make use of the opportunities to think for themselves. The activities are described as promoting all aspects of *Using and Applying Mathematics*. The activities are organised by broad mathematical curriculum areas under the headings: Number, Shape and Space, Measures and Data and Probability.

Section 3 – Solving word problems – children asking questions

is a collection of pictorial resources. These can be downloaded from the ATM website for use on interactive whiteboards. The intention is for children to ask their own questions using a given question as a stimulus. Some examples of open-ended questions and more challenging questions are given for the teacher to model with the children. The purpose of this section is to provide opportunities for children to ask their own questions.

While it is clearly stated that the authors' intention that children are supported through the activities to be able to pose their own questions, they are likely to need a structure to support them in solving questions posed. A problem solving sheet to take them through the process is included.

Resource sheets for duplication for sets of cards and a framework for a problem-solving process are included at the end of the publication. Purchasers also have access to the pictorial resources in Section 3 on the ATM website to enable use with an interactive whiteboard.

As a source of materials to help busy teachers in incorporating more opportunities to encourage children to engage in mathematical thinking, this publication is very useful. It inspires inclusion of this vital aspect of mathematics in lesson planning often driven by the perceived need to 'cover' particular mathematical topics. The approach supported by the publication suggests variety in the teaching of mathematics topics, encouraging diverse opportunities for introduction, consolidation and practice of mathematics content.

Through the activities children are helped to make connections within mathematics thus strengthening their understanding of particular content areas whilst developing their mathematical thinking and practising aspects of *Using and Applying Mathematics*. The activities do not require

complicated resourcing, just regular mathematics resources that are available in most classrooms.

A couple of examples follow in the frames below to illustrate the richness of mathematical activity that is offered through the use of mathematical statements in the first section of the publication. In each case one statement has been chosen to exemplify the kind of mathematical thinking that the approach described in this publication can promote. Clearly both these examples give children the chance to draw on a range of mathematical knowledge and make use of it in order to rise to the challenge posed by the statement. There are rich opportunities for mathematical communication and thinking in the context, in the first case, of 2D shapes, and in the second, of the operation of division and associated understanding of number.

Agree or Disagree

Children are asked to agree or disagree with a statement and give a convincing argument for their position.

- This shape is a circle because it has no straight sides.

Lists

List or draw a set of objects that satisfies the condition stated. Here children are asked to exemplify a generalisation. It gives them an opportunity for a wide variety of responses at different levels. Encourage children to come up with unique solutions.

- Numbers that leave a remainder of 1 when divided by 5

The second section of the publication presents activities in a more familiar format. They could loosely be described as investigative activities and should usefully add to most teachers' collection of such activities. Included with each are some additional hints to help in getting the most out of the activities.

The third section contains stimulus materials to help improve on a particular challenge that the authors describe. That challenge is to help children frame questions themselves so that their understanding of what is required in answering a question is better developed. The resources offered here provide teachers and children with more structured support for developing questions than the all too common extension activity of the invitation to 'make up some questions of your own for a friend to solve'.

In a nutshell, this is an excellent publication with many stimulating ideas that, while being straightforward to set up in the classroom, should promote rich opportunities to develop mathematical thinking and understanding of a broad range of mathematics content.

Mary Clark is a freelance advisor

In the UK & US, three women receive a bachelor of arts or science degree for every two men

Women now gain almost 60% of all medical and law degrees in Britain

For the first time in British and American history, women are now filling half of the nation's jobs

The Observer 9.9.12