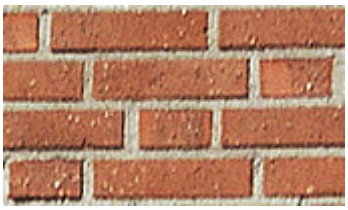
Secondary Magazine Issue 77



National Centre for Excellence in the Teaching of Mathematics

Welcome to Issue 77of the Secondary Magazine.

Contents

Contributors to this issue include: Mary Pardoe, Richard Perring, Mike Ollerton and Peter Ransom.

From the editor

Having survived the first two weeks of term we hope you will have time to look through this issue of the Secondary Magazine – we welcome you!

The Interview is an important part of the magazine – not only do the many interests of, and activities engaged in by, the interviewees provide links to some fascinating sources of ideas and support, but we can also often learn from what they write about the influences of significant, and sometimes chance, events on their life courses.

For example, our interviewee in this issue was in the bottom Year 9 set for mathematics, which, as was quite common in those days, was taught by a teacher who was not a specialist mathematics teacher, but a PE teacher. The thinking was that students who were thought to be unlikely to achieve much in mathematics did not need to be guided, supported and inspired by teachers with a real interest in mathematics and with deep knowledge about the many aspects of doing and learning mathematics.

Fortunately for many teachers and learners of mathematics in subsequent years, our interviewee persevered with mathematics in spite of his capabilities not being understood and developed by perceptive teachers. We might also wonder whether his potential would have been more apparent had he not been trying to learn mathematics in a 'set' in which all the other students were similarly discouraged. As our subject leader observes in Diary of a Subject Leader, students 'feed off each other, listening to the questions others pose and consolidating their knowledge'.

In 5 things to do we remind you of the 2011 Annual Conference of the Mathematical Association - at which our interviewee, Mike Ollerton, will be a speaker.

It's in the News!
VAT changes

The fortnightly *It's in the News!* resources explore a range of mathematical themes in a topical context. The resource is not intended to be a set of instructions but a framework which you can personalise to fit your classroom and your learners.

VAT has been in the news more than you might have liked recently! The increase from 17.5% to 20%, which came into force on 4 January this year, has some predicting drops in spending, with others suggesting little change in spending patterns.

This *It's in the News!* asks students to look at two aspects of the changes. Firstly, exploring how much they'd have to spend for the change to have an impact on their behaviour, and then looking at whether press reports of a 2.5% change in VAT are accurate.

It is intended that this resource generates discussion and raises issues and misconceptions surrounding percentage changes. You might like to include a written report or newspaper article as an outcome.

Download this *It's in the News!* resource - in PowerPoint format

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National Centre for Excellence in the Teaching of Mathematics

The Interview

Name: Mike Ollerton

About you: I guess I would describe myself as a person who has grown to become passionate if not obsessive about mathematics education. I have strong beliefs about the vehicle of problem solving to support the learning of mathematics and of not separating learners into ability groups as a matter of course; at worst I believe this is akin to educational apartheid. I have been fortunate enough to be taught and supported, as an adult, by some excellent people (see below) and this has led me to writing a book or two. I began teaching in 1971 in a primary school for a couple of years, then taught in two secondary schools up until 1995. From 1991-1995 I was seconded half time to Keele University to work on the ITE programme. After a further ten years full time in ITE at St Martin's, Lancaster, I had a brief and best-forgotten return to a head of department post. Since 2006 I have been self-employed – and involved in all manner of interesting projects.

As a child I had a fantastic time at my primary school where I learnt a lot, and an awful time at secondary school, where I learnt little. I learnt I could do mental arithmetic when working on a milk-round from the age of 11 to 16. I learnt about life and the value of having some money in my pocket when working at the Burnley Cabaret Club – to the sights and sounds of the Searchers, the Dubliners, Max Wall and Gerry and the Pacemakers.

The most recent use of mathematics in your job was…
About an hour ago, before starting to write this piece, I was writing to a head of department in a school in Hong Kong. This was in response to a request to help formulate criteria for assessing students' capabilities to use, apply and communicate mathematics.

Why mathematics?
At my school, I only managed to pass O Levels in mathematics and art so had to re-sit my 5th year (Y11) to scrape six O Levels to allow me to progress into the 6th form. Here I studied chemistry because I had a crush on the chemistry teacher, and mathematics because that was the first O Level I had gained. I did not get any A Levels but at that time (1967) there was a great shortage of mathematics teachers – and besides, Bishop Grosseteste College at Lincoln were looking to become a mixed-sex institution – so they accepted me because I had studied A Level mathematics. I guess you could say I fell into mathematics teaching rather than it having been a calling.

Some mathematics that amazed you is…
This may not seem to be particularly amazing but there is a lovely problem that I first met in one of the ATM Points of Departure books. The problem is about making triangles with integer length sides from a given perimeter. The amazing bit is that trying to connect the number of triangles to a given perimeter is not at all straightforward. However, if we allow different combinations or congruencies then something amazing happens.

Here is a simple example. Suppose P = 11, then we can make the following triangles: [5, 5, 1], [5,4,2], [5,3,3] and [4,4,3]. If we now consider combinations; using the [5,5,1] we also allow [5,1,5] and [1,5,5] – we have three possibilities for each isosceles triangle, six possibilities for each scalene triangle and, of course, just one possibility for any equilateral triangle. For P = 11, we have 3 + 6 + 3 + 3 possibilities, which sums to 15… and this is a triangular number! Check this out for other values of P.

Two significant mathematics-related incidents in my life were…
I was in the bottom set in the 3rd Year (Y9) at my secondary school in Burnley. Mr Green, who was actually a PE teacher, taught the bottom set mathematics group (does that sound familiar to anyone?). Anyway, for some unknown reason he taught us how to solve simultaneous equations, explaining that this was the kind of mathematics the top set did. So, there I was in the bottom set and I was successfully working out how to solve simultaneous equations. Not only could I do them but I also knew I was getting the right answers because I could check them myself. That night I went home and filled half an exercise book with the solutions to dozens of questions…and the next day I proudly presented my work to Mr Green.

The second most significant event, mathematically speaking, was joining the Association of Teachers of Mathematics and meeting lots of interesting people.

The best book you have ever read is…
The last book I read which I couldn't put down was Saturday by Ian McEwan. However, I am a very poor reader! My explanation for this is that I have St Vitus' dance (this was what my Mum used to tell me). I just cannot sit still – well, not unless I have a hand of cards to play.

Who inspired you?
There have been five such people and these have been/still are:

- Eric Love, my first head of department (in 1973). Eric inspired me to use investigative approaches and lots of different resources in my mathematics teaching
- **Ali Cooper**, my best friend, who could see my 'career' was going nowhere (in 1982). Ali encouraged me to start studying for an OU degree at the age of 34
- John Mason when I was studying with the OU. John was later to have a profound impact upon my thinking as I worked on my M. Phil
- **Peter Hampson**, the headteacher who appointed me as a head of department (in 1985). Peter was prepared to support me to get rid of all the textbooks, but more importantly to move to teaching in mixed-ability groups throughout the 11-16 age range
- Anne Watson. We were both heads of department developing the ATM-SEG 100% 'coursework' GCSE from 1986. In 1992, Anne became my 'local' M. Phil supervisor and taught me so much, especially how to research and, significantly, how to write at this level. The great thing when Anne and John got married is that whenever we get together it is like a 2-for-1 offer at the supermarket!

If you weren't doing this job you would…
I have (or have had) many 'passions' – which range from fell-walking, football, badminton, tennis, bridge and wailing to myself with a guitar. If I had not fallen into mathematics teaching I guess I would like to think I could have paid my mortgage by doing any of these professionally.

How can we radically improve the learning of mathematics in the UK?
Stop testing as the way of assessing achievement. Instead, as with art students, cause learners to create a portfolio of mathematical achievement which they can 'take with them' into each stage of their future education and employment.

Focus on…brickwork

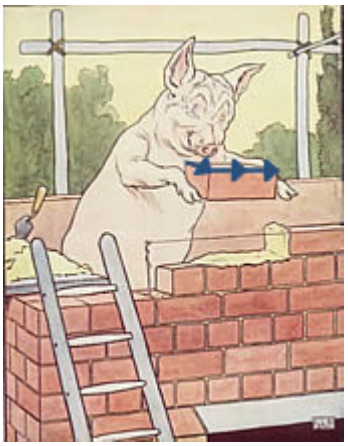
These boys in Bangladesh are moulding bricks from clay – as people have done for thousands of years. Bricks bonded together with mortar form strong, durable walls.

Defensive walls from the Middle Ages by Artur Andrzej

Brick walls are strong if the bricks are placed in horizontal rows, or courses, one course upon another, so that no join between bricks in one course is aligned with a join in a course immediately above or below it.

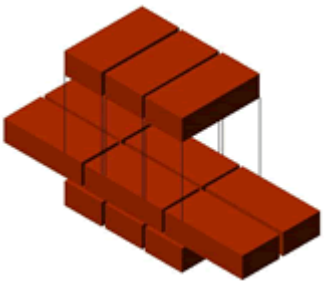
Students can explore different arrangements of bricks while learning about, and observing in their environment, various brickwork patterns.

Normal, 'standard', bricks are twice as long as they are wide.



Three Little Pigs
Illustration by L. Leslie Brooke

Therefore standard bricks can be arranged to create walls of constant width that reveal the long side of some bricks and the short side of others.



Bricklaying Illustration by Gordon

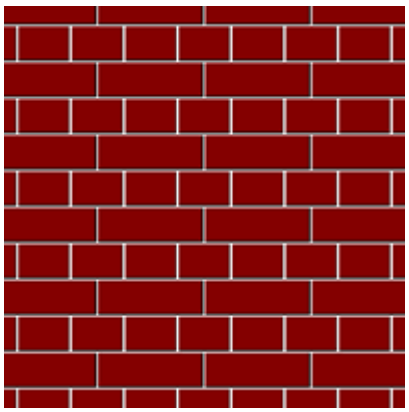
Brick wall illustration, showing stretcher and header, based on photograph by Håkan Svensson

If the long side of a brick shows it is called a *stretcher*, but if the short side shows it is a *header*.

Brick bonds

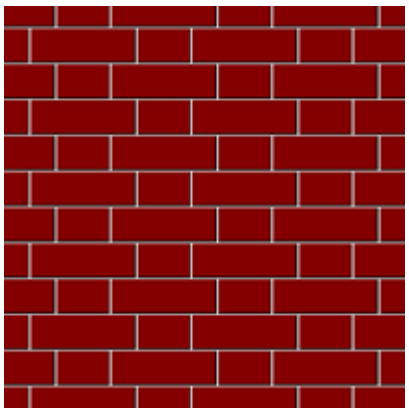
Brickwork patterns formed by *stretchers* and *headers* are called *bonds*.

The commonest bonds are the:



English Bond
by Pbroks13

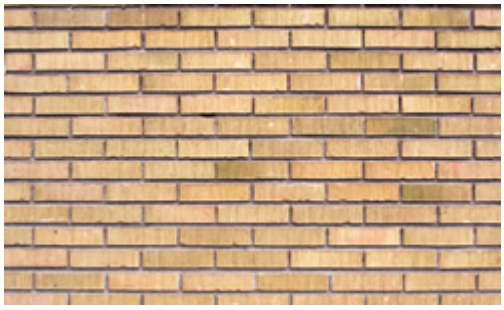
and



Flemish Bond
by Pbroks13

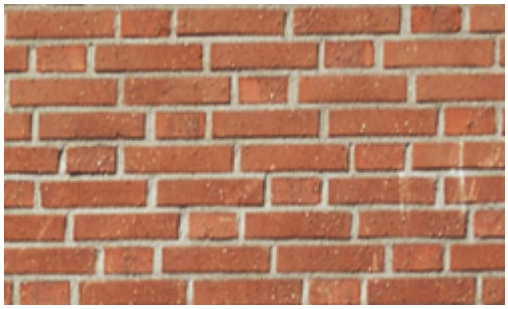
Students may find in their environment many variations of both the English and the Flemish bonds, and also other bonds. They could be challenged to invent their own bonds, and then try to find actual instances of them.

A few of the many other bonds that students might design themselves, or come across, include:

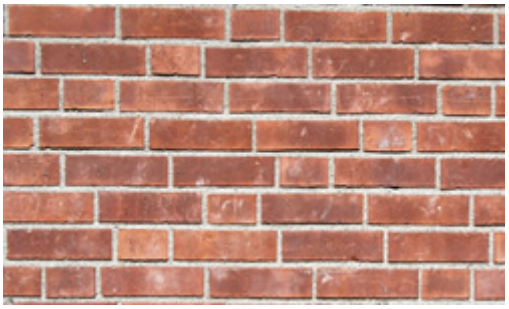


Stretcher Bond
by Håkan Svensson

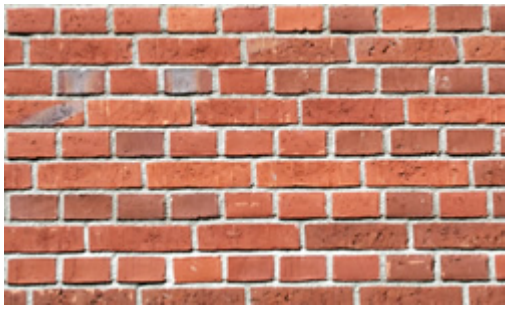
Header Bond
by Deutsche Fotothek



Monk Bond
by Håkan Svensson



Flemish Garden Wall Bond
by Håkan Svensson



English Cross Bond
by Håkan Svensson

Rat Trap Bond
by Andy Potter

Larger copies of these photographs – for classroom display – are in this PowerPoint file.

The Rat Trap bond is a version of the Flemish bond in which the bricks are laid edge-on. Can students picture the view down on such a wall from above it?

You might play and pause this London Bricks video showing parts of brick walls, and ask students what the bonds may be.

Brick colours

Bricks made with different clays have different textures, and may be of many different colours.

You could challenge students to describe clearly – as if in a phone conversation – the two-colour brick patterns shown in these photographs? Can they state any 'rules' that builders might have followed in order to place bricks of particular colours at particular positions within identifiable bonds?

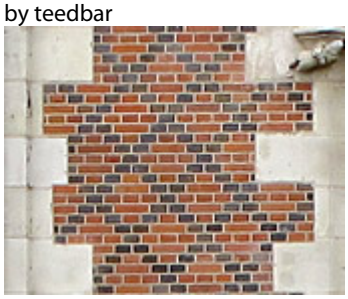
by Holger.Ellgaard

by Marc Roussel

by teedbar

by Marc Roussel

by jp hamon



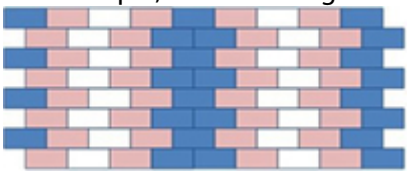
by Shadowgate

Larger copies of these photographs – for classroom display – are in this PowerPoint file.

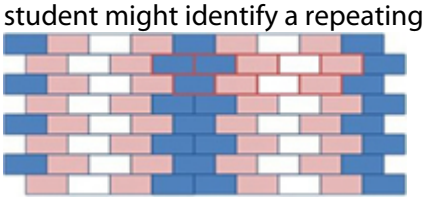
Students might explore the infinite variety of patterns that can be formed in various bonds using bricks of two colours, or three colours, or… . (They could arrange coloured tiles, shade regions of square grids, or even build models using coloured cubes or cuboids.)

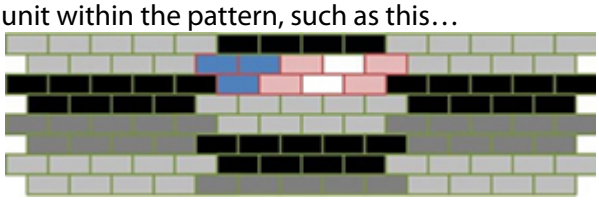
You might challenge students to work out the ratio of the number of bricks of one colour to those of another colour in brickwork patterns that they create, or see in photographs, or find in reality. When doing this they may decide to assume that the patterns continue to infinity in all directions.

For example, a student might design this three-colour pattern in Header bond…



…and challenge herself to work out the ratio of the numbers of bricks coloured white : blue : pink, assuming that the pattern continues to infinity in all directions. When invited to explain her reasoning the student might identify a repeating unit within the pattern, such as this…





…and from it deduce that the ratio of the numbers of bricks coloured white : blue : pink is 2 : 3 : 4.

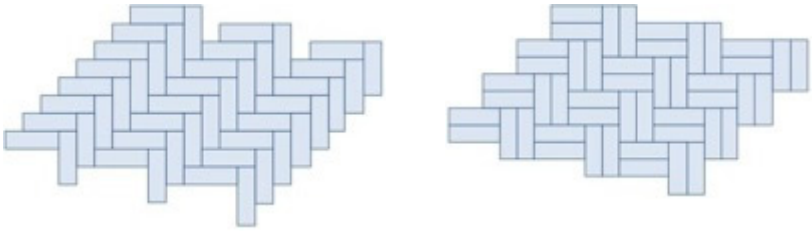
Brick nogging

When timber frames, rather than the bricks themselves, carry most of the weight of a wall, standard bricks can be laid in more decorative arrangements, as shown in these two walls of a house:

Herring Bone brick pattern photographs by Ian Petticrew

Larger copies of these photographs – for classroom display – are in this PowerPoint file.

Students could look out in their cities, towns and villages for examples of bricks arranged in herring-bone patterns such as these:



Vertical Herring-bone Double Herring-bone

Students could explore herring-bone patterns, and relationships between them.

For example, the *Double Herring-bone* image on the right was created from the *Vertical Herring-bone* image on the left by translating some rectangles.
Can students visualise that happening?

- What is the least number of rectangles that had to be moved?
- Which rectangles moved, and which stayed where they were?

The 'bricks' are not standard bricks – the rectangles are three times as long as they are wide.

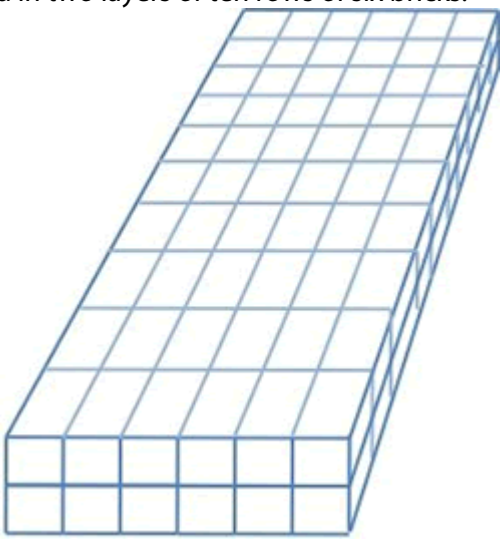
- Did each brick move through the same number of units?
- If each brick is three units by one unit, how many units did each brick move?

The images above obviously cover the same area, but do they have the same perimeter?

How could you create a *Triple Herring-bone* pattern?

Equivalent VIII

In 1972 the Tate Gallery purchased a sculpture, Equivalent VIII, which had been created in 1966 by the artist Carl Andre. This sculpture is often referred to as *The Bricks* because it is a cuboid composed of 120 firebricks. The bricks are arranged in two layers of ten rows of six bricks.



Equivalent VIII is a copy, made by the artist himself, of the last of a series of sculptures by Carl Andre all of which were two-layer cuboids composed of 120 sand-lime bricks. He bought the original bricks from a brickworks in Long Island City. Andre called his exhibition of the original sculptures *Equivalents* because, although they were different shapes, each sculpture occupied the same amount of space in cubic centimetres. And he chose the number 120 to be the total number of bricks in each sculpture because it is rich in factors.

Students might be challenged to find all possible cuboids that can be formed with 120 bricks arranged in two layers of adjacent rows of bricks – before possibly exploring Carl Andre's work.

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Herring Bone brick pattern photographs by Ian Petticrew some rights reserved

5 things to do this fortnight

- The Tenth International Conference on Technology in Mathematics Teaching, ICTMT10, *Enhancing Mathematics Education Through Technology*, will be held at the University of Portsmouth, on Portsea Island, from Tuesday 5 July to Friday 8 July 2011. The deadline for submission of proposals for papers is 31 January 2011. This biennial conference brings together teachers, lecturers, educators, curriculum designers, mathematics education researchers, learning technologists and educational software designers, who are working to improve the quality of the teaching and learning of mathematics by effective use of technology. A theme for ICTMT10 is *Sports and Leisure: Technology as a bridge between mathematics and sport*.

- Have you registered for the RSPB Big Schools' Birdwatch? It is a free data-gathering activity that will take KS3 students about an hour to complete in the school grounds or a local park. Arrange a day between 24 January and 4 February for students to do their watch, having set up some feeders in a convenient place. Students watch birds for a total of one hour, keeping count of how many birds of the same kind they see at any one time. Then they send their results to the RSPB and are entered into a prize draw for 'some fantastic goodies for your school'.

- If you are in London on Tuesday 1 February, you might take in a Gresham College free public lecture by Professor John Barrow, Benford's Very Strange Law, at 13:00 in the Museum of London. You will learn about some surprising statistical phenomena concerning the first digits of randomly chosen numbers, which have helped to reveal fraudulent goings-on!

- Why not explore the possibility of attending this year's Annual Conference of the Mathematical Association, Mathematics: The Big Picture? This three-day event at Loughborough University from 14-16 April will be an opportunity to be inspired by Matt Parker, David Acheson, Lynne McClure, James Grime, and a host of other motivating mathematics educators: Paul Andrews, Lara Alcock, Nina Attridge, Jenni Back, Nadia Baker, David Bedford, Danny Brown, Chris Budd, Bob Burn, Douglas Butler, Steve Chinn, Caroline Clissold, David Crawford, Michael DeVilliers, Rob Eastaway, Michael Fox, Jane Gabb, Tony Gardiner, Charlie Gilderdale, Camilla Gilmore, Paul Harris, Steve Hewson, Ray Huntley, Jane Imrie, Matthew Inglis, Cyril Isenberg, Andrew Jeffrey, Richard Lissaman, Emma Low, Francesca Lyon, John Mason, Adam McBride, Peter McOwan, Liz Meenan, Michelle Moore, Elena Nardi, Catherine Ogden, Mike Ollerton, Chris Pritchard, John Rigby, Anthony Robin, Tom Roper, Liz Russell, Chris Sangwin, Sara Santos, Judy Sayers, Lydia Showan, John Silvester, Amanda Simpson, Ben Sparks, Charlie Stripp, Andrew Taylor, Tadashi Tokieda, Sidney Tyrell, and Liz Woodham!

- The birth date of Georg Cantor is 3 March: if he were still alive he would be 166. He strove tirelessly throughout his sad life to understand and illuminate concepts of infinity. You might put aside a few moments to think of him while watching a short film, The God of Mathematics - Georg Cantor's Infinities (Continuum Hypothesis).

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National Centre for Excellence in the Teaching of Mathematics

Subject Leadership Diary

Well, we've been back a fortnight now and students seem keen at the moment to make up for the school time lost when the snow caused closure. Having lost a few days seems to have put the fire back in their bellies – they seem concerned about what they missed, despite the work and links to websites that we had previously put up on the VLE in case of any disruption. It makes me realise that there's nothing to beat being in a classroom with students – because not only can you see whether they understand, but they also feed off each other, listening to the questions others pose and consolidating their knowledge.

We have just had our annual residential weekend (well, 24 hours) when all the post holders meet in a very pleasant location immediately after school on Friday to discuss what went well over the past year and what might be 'even better if'. We also consider how our School Improvement Plan is going and what we need to think about for the future. There's been much to discuss this year – we haven't yet issued all students with iPhones – I think that was probably a bit too much wishful thinking last year! But our VLE has been overhauled, and, after initial teething problems, seems to be going well (better with the younger members of staff than the older ones). We complete Friday with an excellent late meal, and start again early on the Saturday – methinks some would have benefitted from an earlier night!

It was good to work in cross-curricular groups since it gave everyone a chance to hear the views from other subjects about worries, such as those concerning the English Baccalaureate. I just wonder how many schools let excellent MFL teachers go a few years ago when the compulsory language component at KS4 was dropped and student numbers for languages fell, only to find that they will now have to find more MFL staff. We try to promote languages within mathematics as far as possible by using examples from foreign text books and by providing excellent French publications for students to use during the vacations. The mathematics in those books (which the French students have to buy!) is colourful, contextual and comprehensively covers content in a good chronological fashion. Magnifique! To show that mathematics is a universal language, we also dabble with some Russian and Japanese examples.

We looked at academy status – our governors will now explore this further without prejudice. We need to contemplate all aspects and choose the option that best suits our students, present and future. Having served many years on the Governing Body, I have great faith that the right decision will be made; everything will be considered – even when very difficult situations have arisen in the past the best course of action has been taken.

BETT (the British Educational Training and Technology Show) has just taken place, and I was fortunate to be able to attend for one day. This is the largest education technology exhibition in the world and offers the opportunity to view, touch and test all that is new in the industry. I have attended the annual show at Olympia for many years, and have never been disappointed. In addition to seminars to attend, there are over 600 exhibitors, and so it pays to spend a bit of time planning your route through the show! Interesting exhibits distract me – I remember eating oven-baked crickets one year (a rich source of protein in some countries) on a science stand. There's always plenty of new technology to try and loads of freebees to pick up and bring back – the great many free pens are a useful resource! I return with sample CDs, which I pass on to members of the faculty to review, trying to match the resources with particular staff interests. The 2011 exhibition was very solutions driven, and all content was tied together by the main themes of *Managing Change* and *Learning for Less*.

So it was a very interesting start to 2011, with the promise of much excitement this term!