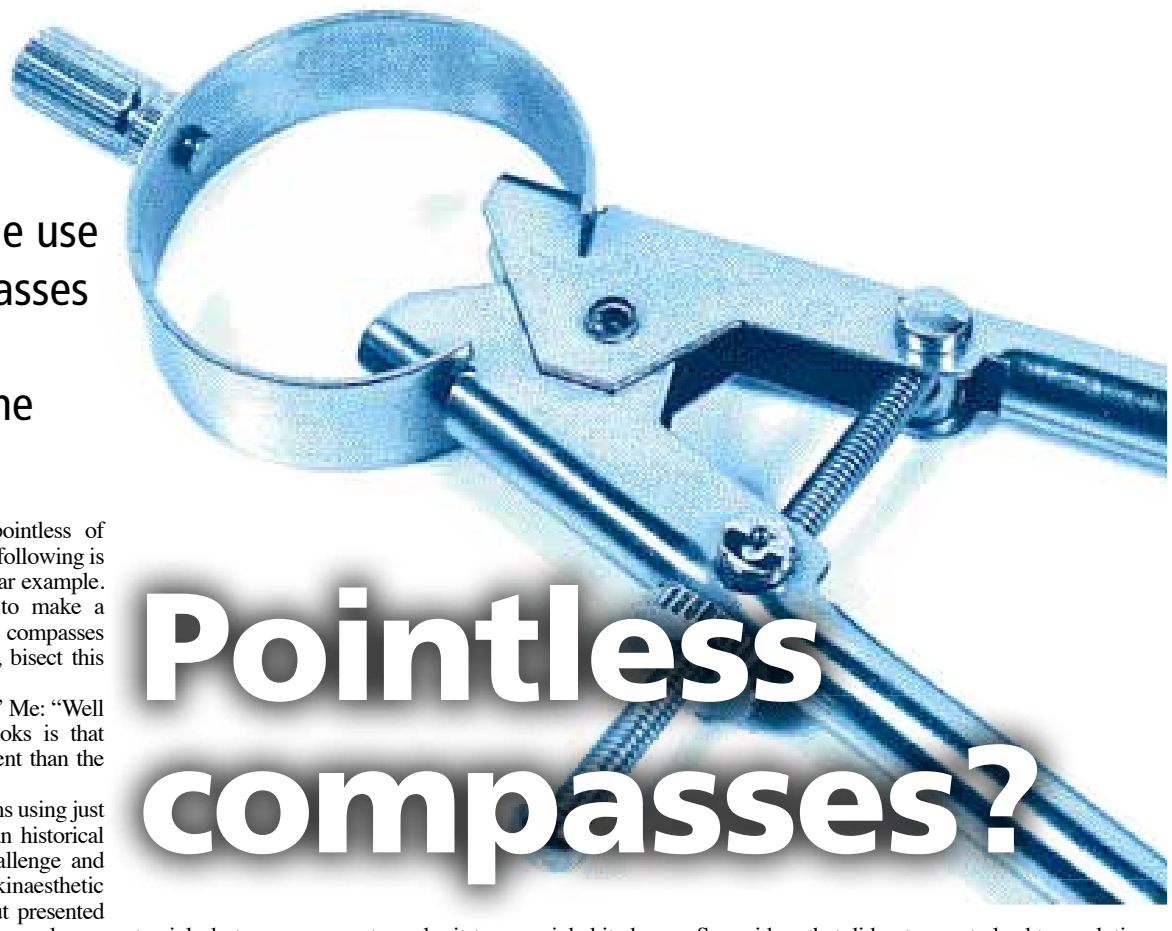
Finding engaging ways of showing the use and purpose of compasses can be tricky. **Colin Foster** points us in the right direction



Pointless compasses?

AMONG THE more pointless of textbook exercises, the following is a particularly spectacular example. "Use your protractor to make a 40° angle. Now, using compasses and straight edge only, bisect this angle."

Pupil: "Why not just draw a 20° angle?" Me: "Well exactly!" The problem with these textbooks is that the pupils who use them are more intelligent than the people who write them.

The task of making accurate constructions using just compasses and straight edge has more than historical interest. It does present an interesting challenge and a much-needed opportunity for some kinaesthetic learning in the mathematics classroom, but presented simply as a way of accurately drawing angles, a protractor is likely to be seen by pupils as far superior to compasses.

To motivate the use of compasses, pupils need to meet tasks where compasses actually allow you to do something that would be much harder, more time-consuming, or less accurate without them. The mathematics behind compass and straight edge constructions is interesting and important – and a useful way of getting acquainted with the properties of a rhombus, so I feel that such topics are a valid part of the curriculum, but I have struggled for some time to find meaningful ways of introducing them. I have recently tried a scenario that I offer in the spirit of an invented puzzle, rather than a realistic context. I asked my year 7 class to use their imaginations on the following story.

Imagine you are travelling on a ship, miles from anywhere, when a storm breaks out. The ship begins to sink, but you manage to make it to an uninhabited island. After a while you realise you are never going to be rescued, so you begin to start building a civilisation. There are plenty of trees and sharp stones so you have wood and can cut it up. You begin to construct buildings, but there's a problem. The buildings keep falling down, because you do not have any right-angles. Right-angles are very important if you want to build buildings that go up vertically and have stable corners. So the challenge is to create a right-angle from what you have got.

My pupils immediately appreciated the idealised nature of the account – this was a "puzzle" to think about for the fun of it, not a real-life practical problem. There was a lot of excitement generated by the difficulty of making something that sounded so simple. Pupils discussed in pairs or threes how they might do it and then we shared ideas.

One idea that I had not expected was the following:

Pupil: "Take a big leaf and fold it in half and then in half again – there's your right-angle!"

Me: "Yes, but the leaf you start with won't have right-angled corners."

Pupil: "It doesn't matter."

Me: "Doesn't it?"

The pupil then showed us with a piece of paper (I carefully tore off the right-angled corners first – he smiled, knowing it wasn't going to make any difference). The first fold makes a straight edge, and then if you fold against that you do indeed get your right-angles. This seemed obvious once shown, but it was a new thought for me – and clearly for the majority of the class, who gave a spontaneous round of applause.

The sort of process I had had in mind did emerge. You make some string (twisting grass together or something) and tie it to some wood and stick it in the ground. This makes your compasses. You can also get a straight line by pulling a piece of string taut, analogous to a ungraduated ruler (straight edge). So pupils set about finding how to make a right angle with their compasses and straight edge.

A follow-on task from this, suggested by the pupils, was to work out how to make a protractor (since the pupils had developed such high praise for that particular instrument!). How did people make the first protractor – did it come down from space? This led to another way of finding a right angle: you make your circle, lie string all the way round the circumference and then unwrap the string and fold it in half and in half again to get quarters of the circumference. You then mark it in some way and wrap it back around the circle to get 90°, 180° and 270°.

In principle you can divide up any angle into any number of portions using this method (by deftly folding the string back on itself however many times you need, like the way you fold an A4 letter into three equal pieces to get it into a long envelope), and so make your protractor.

For me, the positive side of this lesson was the creative ideas of the pupils, and the fact that far more thinking was going on than has been the case in the past when I have taught compass constructions in a "watch me; now do this" kind of way. I have never found that style of teaching very effective – many pupils seem to forget the procedures very quickly – and I hope that this more engaging approach will have more long-term benefit. SecEd

Some ideas that did not seem to lead to a solution:

- Make a circle in the sand and cut it into four quadrants – but how would you get the four quadrants exact?
- Use the angle between a plumb line and the ground – but is the ground exactly horizontal? (Incidentally, one pupil believed the piece of equipment in question was a "plum line" and you were supposed to use a plum for the weight, which hopefully you would find growing on the island, but if plums were not available others felt that any round fruit would do!)
- Hold out your hand and use the angle between your thumb and first finger – but how accurate is that, really?
- A strong sense that you could do something with a straight stick and shadows from the sun, but exactly what was never clearly articulated

• Colin Foster teaches at King Henry VIII School in Coventry

Specialist Schools and Academies Trust

The impact of school-led leadership

MOST PEOPLE will agree that raising standards and providing all students with the opportunities to maximise their potential are central to a first class education system, even if there are differing views on how this is achieved.

Since they were established in 1994, specialist schools have gone a long way in reaching this goal and we have seen significant improvements in the opportunities offered and standards reached by students. Research by the SSAT and Professor David Jesson from York University has shown that specialist schools have achieved significant improvements in terms of raw results, value added, and contextual value added measures over time, and that the majority of the new academies are not only showing improved results, and the value they add when compared with their predecessor schools, but are also making a positive impact on schooling in their communities.

I think there are several reasons why we are seeing these positive developments, including the focus and individual identity a specialism gives a school, the advantages and expertise business and community partnerships can bring, and the efforts of teaching staff and students.

However, there is another, perhaps more important, explanation. The impetus and momentum provided by the school and practitioner-led network of over 3,000 specialist schools and academies affiliated to the SSAT represents one of the best global examples of school-led system leadership, a model that has made a big impact and provided a catalyst for improvement.

The SSAT operates on a "by schools for schools" principle and it is schools and their leaders who lead, shape and develop both what we do and how we do it. Through regional contacts, specific programmes, the specialisms, the community element, and various groups and activities, schools are leading and developing the agenda and then sharing their best practice with others. This is in contrast to more conventional top down approaches to school improvement, which result in schools being "done to" and reacting to change rather than driving it.

Professor Hopkins believes system leadership "refers to a school or school leader that is willing and able to shoulder wider roles and in doing so to work to improve the success and attainment in other schools as well as their own". To me this also provides the impetus for the longer-term transformation of the learning agenda. This decade has provided the chance for schools to lead reform. We're already witnessing this and at the heart of the SSAT's work is the importance of sharing and developing best practice and experiences. Examples of this are two major programmes: *Raising Achievement Transforming Learning*, and *Leading Edge*.

The first seeks to embed innovative and energising ways of schools working and learning together. It has the potential to show what schools are capable of if they create the capacity to work with partner schools on their own improvement agenda. To date over 500 schools have been involved in the two-year programme, which is aimed at schools who have shown a decline in improvement and which matches them with high achieving schools who deliver the programme. Through the use of tailored and innovative methods, a strong focus on ICT, and a series of events, the programme is designed not as a quick fix, but to ensure long-term sustainable change. Schools taking part have already shown significant improvements in their results.

The second of the aforementioned programmes has been running for three years and now involves 1,000 schools. The programme offers funding to a high achieving lead school, which develops a network of local partnerships.

So, across the country, schools are working together to share and develop best practice at a national and international level. The opportunity is not just to raise achievement within the system, but to develop the transformation agenda and our knowledge of both what works and how it works.

• Former headteacher David Crossley is the director of achievement networks at the Specialist Schools and Academies Trust.

Specialist Schools and Academies Trust
EXCELLENCE AND DIVERSITY

conquermaths™
www.conquermaths.com

Every teacher could do with an extra 'pair of hands'.

Designed originally to support struggling Australian maths students at home, the ConquerMaths™ UK Schools Edition is now being recognised by maths teachers up and down the country as the most valuable GCSE supplementary support program available online.

Patrick Murray, an exceptional working maths professional, provides you with that "extra pair of hands" by giving your GCSE students internet access to 480 concise 'living' tutorials and topic tests from Key Stages 3 and 4, together with worksheets, automatic marking and personal summaries. They can 'fill in their personal gaps' whilst you monitor their individual work and progress online. No training is necessary for either yourself or your students.

"Our results have got better and every day we have kids using it, just because they want to get better at maths. You have to use it to see the impact it has."

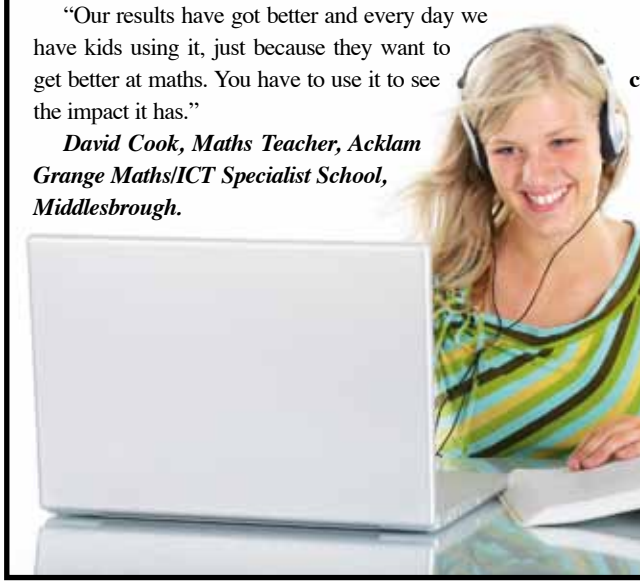
David Cook, Maths Teacher, Acklam Grange Maths/ICT Specialist School, Middlesbrough.

"We are using it not only for the pupils to do individual revision but also for teachers to provide a specific homework. The beauty is that all I have to do is then check the statistics as the pupil gets automatic feedback. I would heartily recommend it."

Shelagh Wright, Head of Maths, King Ethelbert School, Folkestone.

"My students have a huge variety of difficulties ranging from Autistic Spectrum Disorders, Specific Learning Difficulties, ADHD, Dyspraxia, Dyslexia and many, many more. These lessons with their audio and visual input have allowed my students to work on their own individual needs without having to wait for assistance.

Ros Horton. Head of Maths. Selly Oak MLD Special School, Birmingham



This acclaimed program is currently available at an Introductory Fee of £3 per student for the 2006/2007 academic year. Please go to www.conquermaths.com/schools for further information and full testimonials. Or telephone a member of the ConquerMaths™ Team on 01670 510888