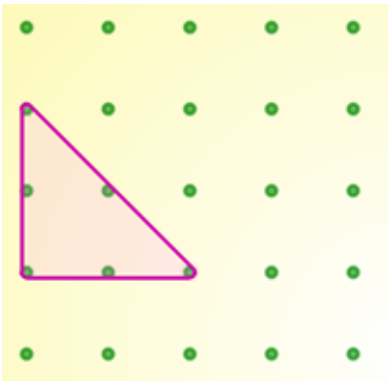
Take a... Geoboard

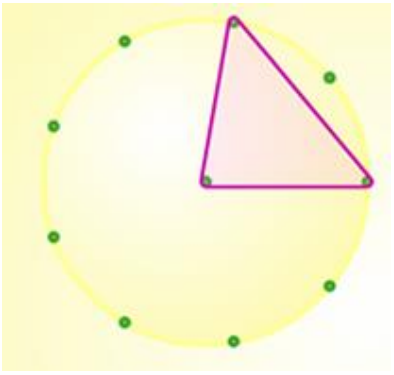
By Liz Woodham

In addition to this article, you may like to read Manipulatives in the Primary Classroom which offers research-based guidance about using hands-on equipment in the teaching and learning of mathematics.

In this article, we draw your attention to a selection of NRICH tasks which make use of geoboards, all of which are contained within our Geoboards Feature. We outline how they can be used to develop a range of mathematical concepts plus an ability to work systematically and to think strategically. Geoboards are an invaluable manipulative for any classroom, at primary or secondary level, to support children's mathematical development and are often under-used. Here at NRICH we rate geoboards very highly!

Geoboards, sometimes called pegboards or pinboards, are boards with nails in a particular pattern. Usually, they are square or circular:





Square geoboards lend themselves to supporting children's understanding of concepts such as area and properties of shape. Circular geoboards are excellent for exploring angles, for example.

Ideally, learners will be able to experience working with 'real' geoboards in the classroom. However, if this is not possible, dotty paper could be used and/or these virtual geoboards. This free app may also be of interest. Of course, a virtual geoboard also enables you to set up your own questions for children to explore and for them to pose, and solve, their own questions too. (This NRICH interactive could also prove useful.)

Exploring area

Happy Halving is a an example of a task which will develop children's understanding of area by challenging them to halve the shapes on a square geoboard. In this activity, the two halves have to look exactly the same as well as have the same area. This could provoke some interesting discussion amongst the class as learners can be encouraged to explain *how they know* the two halves are identical, possibly through some pencil and paper recording.

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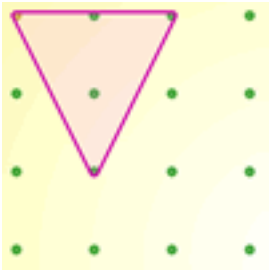
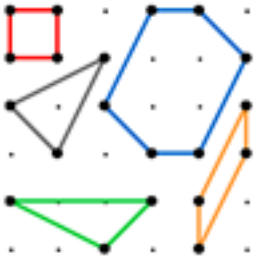
At a higher level, Pebbles will further deepen learners' understanding of area. This investigation gives children the chance to make their own decisions - how to approach the task, how to record and what to record. They will be immersed in exploring area but at the same time they might be looking for number patterns and trying to explain why those patterns occur.

Developing systematic working



Two of the activities in the feature, Inside Triangles (based on a square geoboard) and Nine-pin Triangles (based on the circular version), offer opportunities for working systematically in a spatial context. In order to tackle each of these tasks, learners will need to know the properties of a triangle, but being asked to 'draw as many different triangles as you can' is not straightforward. How will they define 'different'? In both cases, learners could choose to record the triangles they have found on dotty paper. Transferring the images from the geoboard onto paper can be challenging for some pupils but it may prove useful in addressing which are the same and which are different. How will children know they have not missed any triangle out? In order for children to become better at working in a systematic way, not only do they need to understand what that means, but they also need many opportunities to practise. Both of these activities would fit very well into a suite of 'working systematically' challenges. These two activities, Inside Triangles and Nine-pin Triangles are also useful contexts in which to encourage learners to use visualisation.



Transformations on a Pegboard is a richer example of many standard 'shape and space' activities. As they tackle this problem, learners will be comparing and classifying shapes based on their properties but, once again, they will be making decisions about how to approach the task for themselves. They will discover that there is more than one solution for the first part of the problem, so then the question becomes 'How many are there?', leading on to 'How do I know I've got them all?' and of course then we are back into working systematically territory.

Thinking strategically

Finally, in this Geoboard Feature, we offer you a linked pair of strategy games: Board Block and Board Block Challenge which both make use of the circular geoboard. These games combine reinforcement of properties of shape with higher-order thinking in terms of developing a winning strategy. A virtual geoboard comes into its own here as the game can be tailored to suit the players, for example by changing the number of points around the circle in each case. As with any game, it is important that learners are given time simply to play the game many times without worrying about strategy at first. (Our Strategy Games Feature explains further how

you might support children to develop a winning strategy and how to structure a lesson using such a game.)

Geoboards and the new National Curriculum in England

Those of us teaching in England are currently (January 2014) in the transition phase between old and new national curricular. The new mathematics national curriculum contains more challenging content compared with the old version. In this context therefore, mathematical models are of even more importance to help children grasp concepts and have mental images to draw upon as the complexity of challenge develops. (To find out more about the importance of mathematical models, see the articles From Objects and Images to Mathematical Ideas and Models in Mind).

And finally....

Geoboards may well be a new manipulative for your school, or they may be one that is not yet exploited to its full potential across the curriculum and across year groups. Have you thought of using them to develop children's ability to work systematically, for example? Have a go at some of these NRICH activities and discover the power of the geoboard for yourself.

With thanks to Geoff Faux for his contributions on the creative and effective use of geoboards.