What is spatial reasoning?

Spatial reasoning is the ***ability to understand the spatial properties of objects*** such as their size and location, and to visualise objects and problems in the mind.

Visualisation has been compared to having a mental blackboard and is extremely ***useful for mathematical problem solving***, particularly non-routine problems and mathematical word problems.

Spatial Reasoning has real world relevance. For example, timetables and graphs are spatial representations of data, right through to reading a map, packing a bag or building flatpack furniture.

Why is spatial reasoning so important?

Spatial reasoning has the potential to ***reinvigorate the way we teach children ALL kinds of subjects*** in the curriculum, and improve mathematical understanding, attitudes and attainment.

There is a large body of research showing that ***children with good spatial reasoning skills are also better at mathematics.***

Spatial reasoning can be trained, and spatial training has a positive impact on both spatial ability and mathematics attainment.

Research has shown that spatial training is particularly helpful in ***closing attainment gaps***. This is likely because children from economically disadvantaged backgrounds typically have lower spatial skills, lower spatial language and reduced access to spatial toys.

For more information about how to use spatial reasoning in the maths curriculum, visit: **surrey.ac.uk/spatial-reasoning**

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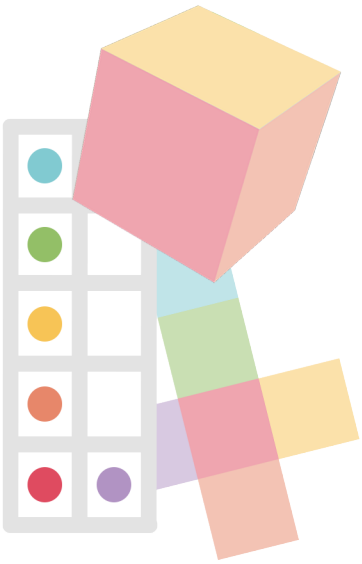
How can we apply spatial reasoning in the classroom?

Introduce visualisation into problem solving



Visualisation is a useful strategy for predicting how things might fit together and for manipulating objects mentally. However, it can be difficult, and not all children use visualisation as a strategy. Adults can encourage and help children to use this skill.

To encourage visualisation, ask children to think about a problem in their head. Can they use that picture in their head to help them to solve a problem? Children can use visualisation to imagine where a midpoint is on a number line, or to imagine a tens frame to solve simple calculation problems. They can imagine shapes when calculating perimeter or to count how many sides a shape has. They can use visualisation to create a picture in their head of a maths word problem, or to mentally manipulate a 2D net of the faces of an object into a 3D object.

Use spatial language and gesture

Spatial language includes words to describe spatial relations such as 'above', 'between' and 'next to', as well as words for shapes, size words and spatial comparative words such as 'bigger' and 'shorter'. As children develop, they begin to understand spatial words like 'on', 'under', 'between' and 'behind', but spatial words like 'left', 'right' and 'diagonal' are still challenging for children throughout the primary school years.

Adults using spatial language has a positive impact on young children's spatial and mathematical understanding. Could you make a simple change from directing children using the word 'there' to use spatial words like 'the lowest shelf' or 'to your left'? For older children, adults can introduce more sophisticated terms such as "slope" or "parallel", and use gesture to support their visualisation of the concept.

Use spatial representation

We can represent information spatially using diagrams, graphs and sketches. We also use tools such as number lines and tens frames to represent numbers spatially. As adults, we use this type of representation daily. For example, when we look at a bus route, read a map, or follow the instructions for flat pack furniture. As children develop, they begin to recognise spatial properties of objects and spatial relations between them, and develop ways to represent these. They become familiar with using pictures, maps and diagrams as representations of real-world objects.

Adults can encourage children to use spatial representation in mathematics activities by drawing part-whole diagrams or bar models to support reasoning about arithmetic, or by using spatially based representations of numbers. Adults can help children to understand diagrams by asking children to compare the scale on the Y-axis between two bar graphs. Adults can also encourage children to create their own diagrams in the form of sketches, to help children to actively learn a mathematical concept in a spatial manner. Good representation skills also support children to use visualisation.