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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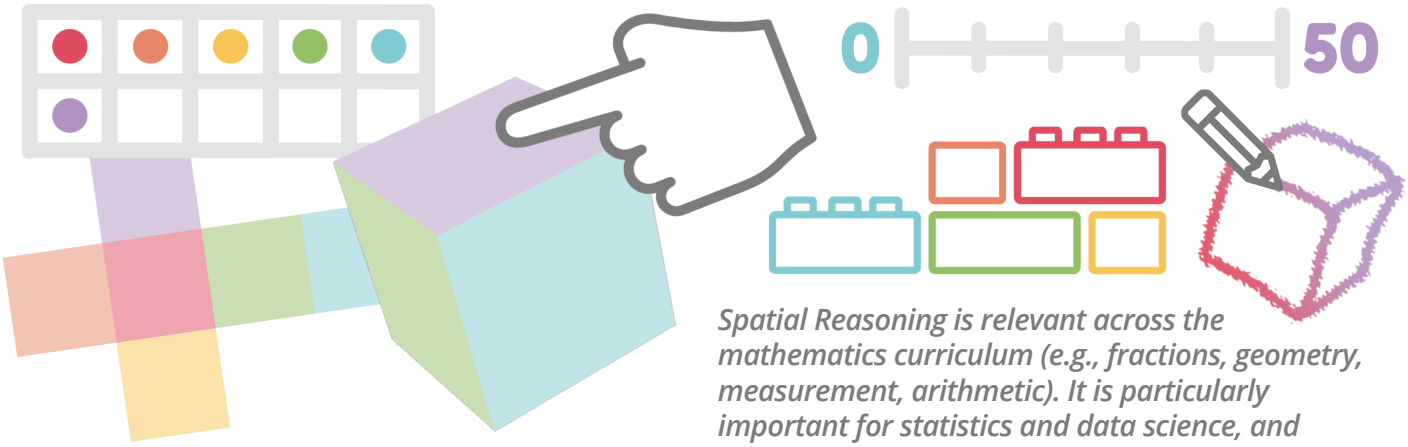
How can we build spatial reasoning into the curriculum?

Spatial reasoning is the route to children who are better at maths. Better maths, means better problem solvers, better long term STEM outcomes and a ***more resilient and productive STEM workforce*** of the future.



There is a robust evidence base that Spatial Reasoning is an important foundation for the development of Mathematical and Quantitative Literacy, for all pupils.

Recommendation: Increase explicit reference to spatial reasoning in the EYFS framework and all KS national curricula, for example by reinstating the Early Learning Goal related to "shape, space and measure". A spatialised mathematics curriculum should focus on the importance of: visualisation for problem solving (i.e., using a mental blackboard); spatial representation of numbers, data and relationships; and the use of spatial language and gesture.

Spatial Reasoning supports problem solving, decision making, computational thinking, data science and the ability to question quantitative claims, all core components of Quantitative Literacy.

Recommendation: Policy documents should state the central role of spatial reasoning in the current employment revolution; data is now central to a broad range of occupations, and data science (much of which is underpinned by spatial reasoning) is becoming increasingly important such that "continuing with our present [curriculum] arrangements condemns the UK to life in the slow lane" (Royal Society, 2023).

Spatial Reasoning is relevant across the mathematics curriculum (e.g., fractions, geometry, measurement, arithmetic). It is particularly important for statistics and data science, and mathematical problem solving, as well as for other subjects (e.g., geography, PE, music, computing, Design and Technology, Science).

Recommendation: Highlight the importance of spatial reasoning in the Ofsted assessment framework for mathematics and STEM, for example, referring to spatial reasoning in the "School inspection handbook" with reference to mathematical reasoning and solving problems.

Spatial reasoning supports learning at all levels of mathematics education, from early years to university level. A spatialised curriculum is engaging, reduces attainment gaps, and could mitigate the development of a negative view of mathematics.

Recommendation: Ensure that statutory assessments do not prioritise rote retrieval and processes to the exclusion of spatial reasoning problem solving approaches.

Spatialising the curriculum requires practitioner access to Professional Development on the importance of Spatial Reasoning of Mathematics.

Recommendation: Include the importance of spatial reasoning in the Early Career Framework (the support and development offer for teachers at the start of their career).