Spatial Reasoning Toolkit

Enhancing children's early mathematical learning

Spatial reasoning improves mathematics understanding

- Spatial reasoning involves understanding the position, dimensions and properties of objects and their relationships to one another.
- Aspects of spatial reasoning include position, direction, navigation, orientation, shape properties and composition, scaling and perspective taking.
- We use spatial reasoning every day: to stack the dishwasher, navigate to unfamiliar places and put together flat-pack furniture.
- Spatial reasoning can be trained from an early age and improves children's mathematics skills, particularly for children from disadvantaged backgrounds.
- Spatial activities are highly engaging and enjoyable for children.

A spatial reasoning resource supporting practitioners and families

0-7 years — Designed to assist practitioners and families supporting children from birth to 7 years.

Offering evidence-based practical support to enhance young children's mathematical skills.

Resources include videos, book lists, posters, a summary of research evidence, and a developmental trajectory for spatial reasoning skills and understanding.

Reaching a wide audience since launch

2,109 Videos

498 Posters

34,879 Online views of the toolkit:

4,091 Research summary and development trajectory

492 Book ideas

Spatial Reasoning Toolkit

5,481 presentation attendees

Articles shared with **260,124** contacts

3,313 engagements on Twitter

113,794 Twitter impressions

*Data from launch on 28.2.22 to 28.2.23.

The Spatial Reasoning Toolkit appeals to many different types of users

Pre-school
- Nursery Practitioners
- Childminders

Primary Schools
- Teachers
- Teaching Assistants
- Mathematics Subject Leaders
- SEND leaders
- Early Years leaders

Families
- Parents and Carers

Higher Education
- Teacher Educators
- Student Teachers
- Mathematics Education Researchers

Receiving positive practitioner feedback

Use of the Spatial Reasoning Toolkit

A flexible, useful resource for all practitioners

"I have never looked at spatial reasoning in as much detail as I have since this ... it's opened my eyes to the small steps [of progress]."
Primary Maths Subject Leader

Multi-purpose use

Easy to use, multi-modal resource

"I have found your trajectories really specific and easy to use."
Early Years Practitioner

Suitable for curriculum integration

"I embedded the spatial reasoning objectives out of the toolkit into the medium term [curriculum] planning."
Primary Senior Leader and Maths Subject Leader

"We used it [the toolkit] .. in different lessons across the curriculum."
Year Two Teacher

Impact of the Spatial Reasoning Toolkit

Empowering practitioners

"It's definitely given me more confidence."
Nursery Class Teacher

Positive impact on children's spatial reasoning

"I think [my pupils are] coming out with better spatial reasoning than [the cohort] two years ago."
Reception Teacher and Early Years Lead

Child-led learning

"They [the children] got to take ownership of their learning in a way where it wasn't just us talking at them."
Year Two Teacher

"It's [the toolkit] allowing me to focus more on letting the children play with their agenda."
Reception Teacher and Early Years Lead

Ideas for using the Spatial Reasoning Toolkit

Spatial Week in Year Two.

Practitioners in a large urban primary school used the Spatial Reasoning Toolkit to design a focus week on spatial reasoning for Year Two pupils. Spatial Week ran in the Summer Term. Spatial reasoning activities were incorporated into many parts of the school day across different subjects.

The days started with spatial language games such as 'Teacher Says' asking the children to draw shapes in certain orientations and in relation to other shapes. In P.E., children created obstacle courses and completed them being supported with spatial language. In geography, children navigated the school grounds to locate items and drew maps. In maths, nets were used to discuss 3D shape properties.

During reading, books relating to shapes, space and measures were used to support children's understanding of spatial reasoning concepts. In choosing time, jigsaw puzzles allowed pupils to practice their visuo-spatial skills such as mental rotation. All the activities were engaging and fun and provided a contrast to desk-based learning. The result from just one week of focused spatial reasoning training was a significant improvement in children's spatial language skills. An added benefit was the social development opportunity provided by these team-based, predominantly child-led activities. Practitioners have now incorporated many of these ideas into their curriculum planning for Year Two.

Spatial reasoning integrated into the curriculum.

In a small, coastal primary school the Spatial Reasoning Toolkit facilitated a strategic decision to embed spatial reasoning objectives into the Key Stage One maths curriculum. Staff took time to explore the content in the research summaries and learning trajectory to understand what spatial reasoning encompassed. The videos were used for staff training and prompted discussions about how to introduce spatial reasoning into lessons. The posters were used on classroom walls to provide spatial reasoning ideas and language prompts to support practitioners in teaching moments. Similarly, in Early Years, spatial reasoning objectives were extended in the medium-term maths planning. Continuous provision now incorporates elements of spatial reasoning to support the relevant development steps.

In Reception, books, such as Rosie's Walk, have been used as a base for teaching a range of spatial skills across a whole week. Topics such as perspective taking have allowed children to consider objects and places from different viewpoints and develop their prepositional language skills. As a result of this work, practitioners have an increased understanding and awareness of the importance of spatial reasoning and how teacher-led and continuous provision environments can support it. One of the biggest impacts for children has been an increased comprehension of spatial language and their ability to use it in the appropriate context.

SCAN ME

Scan the QR code to visit the Spatial Reasoning Toolkit

University of Surrey · Centre for Educational Neuroscience · Early Childhood Maths Group · University of Nottingham UK | CHINA | MALAYSIA · University of Roehampton London · UKRI Economic and Social Research Council