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Let's talk about space!

Katie Gilligan-Lee
explores the importance of spatial language for developing spatial and mathematics skills

Every time we put on our shoes, fill a backpack, or make our way to work, we rely on our spatial reasoning skills. More generally, we use spatial thinking to understand the location (position) and dimensions (such as length and size) of objects, and how different objects are related to each other. However, beyond these day to day uses, recent research also shows that having better spatial skills is associated with improved performance in Science, Technology, Engineering and mathematics (STEM) domains (Mix et al., 2016). This has led to a movement to encourage "spatialisation" of the primary school classroom, whereby spatial thinking is embedded into existing school curricula and lessons. Spatial language has been proposed as one tool that can be used for supporting and enhancing spatial thinking (Newcombe, 2010).

Spatial language is the language of spatial concepts and spatial relationships. Spatial language includes relational/direction words including 'on', 'in', 'under', 'on top', 'beside', 'on the bottom', 'left', 'right'; shape words including 'circle', 'square', 'triangle'; and adjectives like 'big', 'small', 'round', 'straight', 'curvy', 'bendy'. Research has shown that most children understand terms such as 'in', 'on' and 'under' by 3 years, but that terms such as 'between' and 'behind' might still be difficult at age four, with relative terms like 'left' and 'right' presenting difficulty even at age seven (Farran & Atkinson, 2016). However, helping children to acquire this vocabulary is vital, as there is evidence that spatial vocabulary is associated with spatial outcomes like understanding spatial categories (Farran & Atkinson, 2016) and spatial transformation (Pruden et al., 2011), in addition to numeracy outcomes.

For numeracy, Purpura and Reid (2016), and Purpura and Logan (2015) found that spatial language (e.g., below, under, middle) and mathematical language more generally, explained additional variation in numeracy outcomes at 3-5 years, above general language skills. In older children (7-11 years), research that I have completed shows

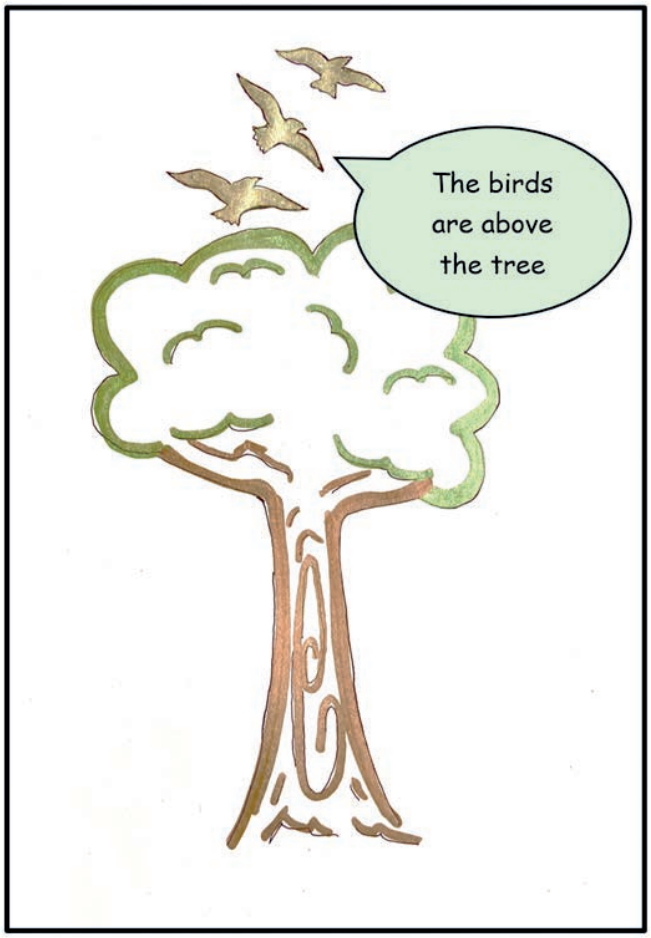

Figure 1: Spatial language can be used when reading picture books, e.g. highlighting spatial relationships like *"the birds are above the tree"*

that as children progress through the primary school years, spatial language remains an important predictor of their spatial and mathematical outcomes (Gilligan-Lee et al., 2021). Thus, helping children to acquire spatial language in the early years and use this language in appropriate contexts for reasoning and problem solving, may continue to offer them advantages for spatial and mathematical problem solving as children get older.

The good news is that there are countless ways to include spatial language-based activities in the day-to-day activities of your classroom. For younger children, books offer a great opportunity for practicing spatial language. Some picture books

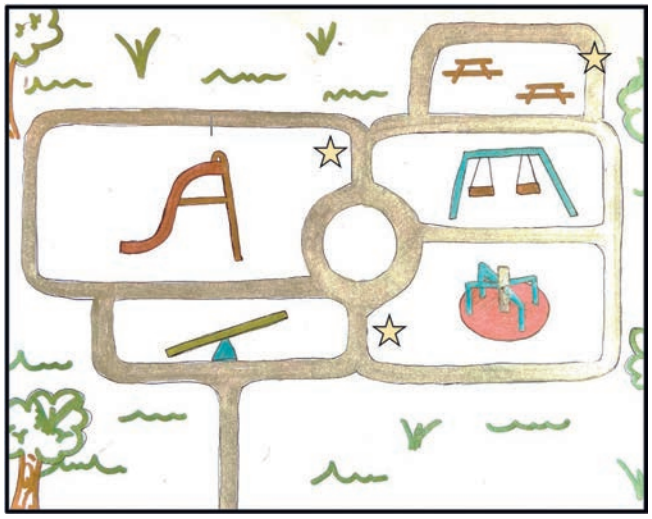

Figure 2: Spatial language can be used with maps. For example, you could ask children to work in pairs to find the three stars that have been hidden in the playground. Only one child can see the map and must give directions to another child to find the hidden stars.

already include a focus on spatial terms, however, if not, spatial relations (and the appropriate terms) can be highlighted in most picture books, e.g., point to the dog that is on top of the bridge, which duck is on the left, which house is the biggest, where are the birds etc. (see Figure 1). You can also encourage children to give instructions/directions in play activities, e.g., a building activity where one child is the builder and the other gives instructions, a treasure hunt where all instructions given are based on spatial directions (see Figure 2). For older age groups, you can emphasise your own use of spatial language. For example, when working with fractions such as ¾, children may benefit from verbally labelling numbers, "3 is above the line, 4 is below the line" (Figure 3). Similarly, for place value questions, verbal cues may be used to describe numbers on the left and right of the decimal place, "whole numbers are on the left of the decimal place, all numbers on the right of the decimal place are fractions". For number line estimation tasks, children can be encouraged to use verbal cues to position items, "50 is in the middle, 75 is between 50 and 100, 5 is closer to 0". Older children can also be encouraged to use spatial language for describing patterns of data on a graph, giving directions etc.

Taken together, spatial language may offer a simple route to developing spatial and mathematics thinking that is not highly resource dependent, and that can be integrated across subject domains. In an effort to spatialise our mathematics curricula, it is time that we started to *Talk about Space!*.

(Illustrations by Charlotte Bradley)

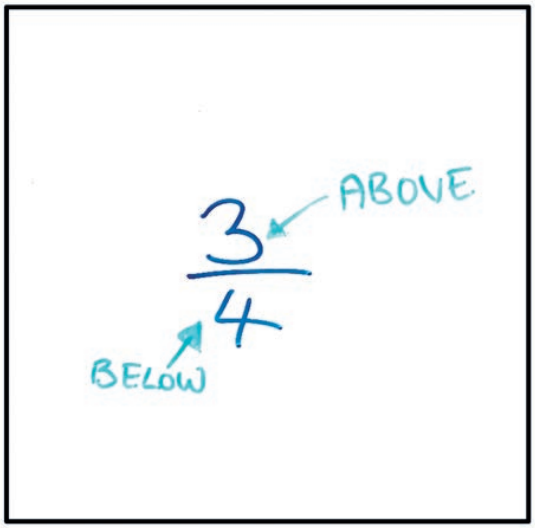

Figure 3: Spatial language can be used to label fractions.

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