

# **BUILDING SPATIAL RELATIONAL SKILLS**

When working on engineering design projects, children will need to be familiar with how to manipulate a variety of materials and tools. To do this, they will need to understand how objects change or stay the same when rotated or attached together, as well as which types of features facilitate attachment between objects. Therefore, it is important to provide children with opportunities to explore the assembly process, practice rotating and fitting things together, and practice making changes when things do not work as planned. Through practice and exploration, children will build their spatial reasoning skills which is not only an important math skill, but will also help with engineering design projects.

The activities below are likely activities that you are already engaging in with children. We recommend prompting exploration during these activities through questions to facilitate children's thinking. For example you can ask questions that start with "What do you notice..." or "How do you think you can use that?" And, you can encourage flexibility of thinking by following up with "Can you think of other ways to use that?"

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## **BLOCK AND PUZZLE PLAY**

Playing with everyday children's toys such as puzzles, blocks, or magnetic tiles is a great way to build spatial reasoning. Children will naturally build their skills through exploration, but adult guidance provides a rich learning opportunity as adults talk about goals and label new concepts.

1. Choose a shape-based activity such as puzzles, tangrams, blocks, or magnetic tiles. If you don't have any of these, you can use anything non-breakable such as empty plastic food containers or boxes.

2. While working on the puzzle or building something together use spatial language to label or narrate what you are working on. Spatial language includes using prepositions (e.g., above, below, next to) "Can you put the yellow block on top of the red block?", shapes of objects and their properties "This is a triangle, it has three sides and three corners", and other terms or strategies "Let's start with the edges" or "What if we rotate this piece?"

3. Encourage children's growth mindset by not jumping in right away to solve problems but rather letting them persist when something does not work as they planned. You can facilitate the process by making observational comments such as "I notice that you are working very hard to figure out where that piece goes," or by asking questions such as "Can you think of another way to try?"

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## **LET'S CONNECT**

When coming up with solutions for engineering design problems, children will create something new by combining available objects and materials. They can prepare by exploring the properties of objects through making connections.

1. Gather any set of tools that can assist with making connections, such as tape, glue, string, paper clips, or clothespins.
2. Gather sample materials that can be connected such as recycled paper products, packing materials, plastic containers, fabric, or small toys.
3. For the youngest children, ask them to identify a tool or resource to connect two materials "What should we choose to connect these two things together?" Make predictions, test them out, and

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discuss what happened "Were you surprised by how the pieces stayed together or didn't stick?" Depending on the outcome, explore new types of materials or try again with something that might work better.

4. For older or more experienced children take it one step further by presenting a simple engineering design challenge such as "How can we make this longer?" or "How can we make something long enough to reach x?" or "How can we make this stronger so that it can hold extra weight?"
5. Children might struggle to get things connected as they want. Allow them to experience the challenge and try different solutions before you jump in to help.

### THINK, MAKE, TRY® COGNITIVE SKILLS

*Causal reasoning:* As children are working on connecting objects, they will engage in causal reasoning as they see how one object impacts another (for example, if they try to attach something heavy to something light or to use certain glue with shiny/coated paper). Encourage their reasoning with focused questions such as "Why do you think the toilet paper tube fell over when you attached the yogurt container?"

*Spatial reasoning:* While working on puzzles or connecting objects, use spatial language (such as above, around, on top) to help children build their spatial reasoning and early math skills.

*Growth mindset:* Children are likely to encounter challenges as they attempt to connect objects. Working through struggle is an important part of developing growth mindset. You can facilitate this learning by asking questions such as "Can you think of another way to try to connect those?" Use process praise "I noticed you worked really hard to get those pieces to stick together."



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