

This module has been designed to support those providing Mathematics Professional learning for K-12 classroom educators.

Spatial Reasoning Overview Presentation Guide

Session Description

Through a variety of classroom ready activities, participants explore the skills of spatial reasoning. They examine research and develop awareness of its importance as well as strategies to incorporate opportunities for students to reason spatially in their instructional practice.

Importance

“Spatial thinking is integral to everyday life. People, natural objects, human-made objects, and human-made structures exist somewhere in space, and the interactions of people and things must be understood in terms of locations, distances, directions, shapes, and patterns.” (National Research Council, 2006, p. 5) Recent research points to the need for educators to be more purposeful and precise in developing spatial reasoning skills in students across the grades.

Learning Focus

Participants will:

- deepen mathematical content knowledge of spatial reasoning
- develop awareness of the key skills associated with spatial reasoning
- develop pedagogical knowledge for teaching spatial reasoning
- engage in spatial reasoning through mathematical tasks

Agenda

Minds On:

- Exploring Pentominoes
- Spatial Reasoning Connections

Action:

- Why Pay Attention to Spatial Reasoning
- Turning to Research
- Cube Challenge
- Taking Perspective

Consolidation:

- Connecting to the Curriculum
- Resources

Session Contents

- Presentation Guide: Overview, Learning Activities, Questions to Stimulate Conversations (as needed), Aha Moments (possible participants' insights), Materials, Adaptations (20 minute, 1.5 hour and 5.5 hour sessions)
- PowerPoint with script and <<presenter notes>>
- BLMs

Learning Activities	Questions to Stimulate Conversation	Aha Moments	Materials
<p style="text-align: center;">Minds On (25 minutes)</p> <p>Introduction (Slides 1 to 4) 5 minutes</p> <p>Exploring Pentominoes (Slides 5 to 8) 15 minutes Participants work together to complete a task using square tiles.</p> <p>Spatial Reasoning Connections (Slide 9 to 10) 5 minutes Participants are presented with definitions of spatial reasoning and have an opportunity to connect to the Pentominoes task.</p>	<ul style="list-style-type: none"> • What does your gesture tell me about your thinking? • How is gesturing connected to spatial reasoning? 	<ul style="list-style-type: none"> • Wow, gestures convey a lot about what a student is thinking. • This task sure highlights the skills of spatial reasoning. 	<ul style="list-style-type: none"> • colour tiles (70 per pair) • (Optional: Colour Tiles by mathies.ca)
<p style="text-align: center;">Action (105 minutes)</p> <p>Why Pay Attention to Spatial Reasoning (Slide 11 to 15) 15 minutes By sharing the research around Spatial Reasoning, participants will understand the importance and the possibilities.</p> <p>Turning to Research (Slide 16 to 17) 30 minutes Participants will engage in a jigsaw reading activity to learn more about the three main reasons to pay attentions to spatial reasoning.</p> <p>Cube Challenge (Slides 18 to 21) 30 minutes Using linking cubes, participants identify the different combinations possible to understand the multiple skills of spatial reasoning and the connections to mathematics learning.</p> <p>Taking Perspective (Slides 22 to 25) 30 minutes Using linking cubes, participants build a three-dimensional figure given the three perspective images to understand the multiple skills of spatial reasoning and the connections to mathematics learning.</p>	<ul style="list-style-type: none"> • What is surprising to you about these skills? • What aspects of spatial reasoning would you say you are strong at? Challenged by? 	<ul style="list-style-type: none"> • Now I understand why one of the elementary curriculum's Math strands is called Geometry and Spatial Sense. • There sure are a lot of skills involved in spatial reasoning. • Spatial thinking is a good predictor of mathematics success • Spatial thinking is malleable. 	<ul style="list-style-type: none"> • <i>Paying Attention to Spatial Reasoning</i> (1 per participant) • chart paper • markers • tape • interlocking cubes (100 per pair) • grid

Learning Activities	Questions to Stimulate Conversation	Aha Moments	Materials
<p>Consolidation/Debrief (20 minutes) Connecting to the Curriculum (Slide 26) 15 minutes Participants identify opportunities for spatial reasoning with the Ontario Mathematics Curriculum</p> <p>Resources (Slide 27) 5 minutes</p>	<ul style="list-style-type: none"> Think about the types of tasks you would use to teach <content>. How would students use spatial reasoning skills in those tasks? 	<ul style="list-style-type: none"> I can have students use their spatial reasoning skills in number sense. Some of my students have strong spatial reasoning skills. 	<ul style="list-style-type: none"> sticky notes Ontario Mathematics Curriculum (1 per table)

Suggestions if you are offering the session as part of a series:

Select, or have participants select, one of the ‘Try This!’ activities in *Paying Attention to Spatial Reasoning* to have their students complete. They return with student responses and any trends noted in constructs used.

Considerations if you are offering the session on-line:

Use chat pods for activities which include partner dialogue. Label distinct chat pods (for example, with slide 10, create a chat pod labelled “Skills Used” and create an additional chat pod labelled “Skills to Learn About” and have participants record their thoughts accordingly). In this manner, the ‘Skills to Learn About” pod can be brought in for subsequent discussion, such as at slide 15.

Adaptations	Materials
<p>If you have 20 minutes: <i>Learning Focus:</i></p> <ul style="list-style-type: none"> develop awareness of the key skills associated with spatial reasoning engage in spatial reasoning through mathematical tasks <p><i>Activities:</i></p> <ul style="list-style-type: none"> Use only Exploring Pentomino Activity (slides 5-8) and Turning to the Research (slide 16). Provide participants with Paying Attention to Spatial Reasoning (draw attention to pages 5-9). 	<p><i>Paying Attention to Spatial Reasoning</i> (one copy per participant)</p>
<p>If you have 1.5 hours: <i>Learning Focus:</i></p> <ul style="list-style-type: none"> deepen mathematical content knowledge of spatial reasoning develop awareness of the key skills associated with spatial reasoning develop pedagogical knowledge for teaching spatial reasoning engage in spatial reasoning through mathematical tasks <p><i>Activities:</i></p> <ul style="list-style-type: none"> Omit Turning to Research jigsaw activity (slide 17) and Taking Perspectives activity (slides 22 to 24). 	<p>See 2.5 hours outline</p>
<p>If you have 5.5 hours: <i>Learning Focus:</i></p> <ul style="list-style-type: none"> deepen mathematical content knowledge of spatial reasoning develop awareness of the key skills associated with spatial reasoning develop pedagogical knowledge for teaching spatial reasoning engage in spatial reasoning through mathematical tasks <p><i>Activities:</i></p> <ul style="list-style-type: none"> Follow up with Spatial Reasoning: Composing and Decomposing Tasks Module (2.5 hours) and have participants read Spatial Reasoning across Strands and Grades (pages 14-19) as a jigsaw (0.5 hour). 	<p>See 2.5 hours outline</p>