

Seeing Mathematics Everywhere

[A Joy2Learn Professional Development Mini-workshop](#)

Alignment to the Standards for Mathematical Practice and the Common Core State Standards

MP1: Make sense of problems and persevere in solving them

Teachers begin by asking students to observe a real-world object, pose questions, and make sense of what they see before introducing formal mathematics.

Examples:

- "What do you notice?"
 - "What mathematical ideas do you see?"
 - "Can a structure be both concave and convex?"
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MP2: Reason abstractly and quantitatively

Students connect concrete visual examples (buildings, sculptures) to abstract mathematical ideas such as:

- scale
 - measurement
 - ratios
 - surface area
 - volume
 - geometric properties
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MP3: Construct viable arguments and critique the reasoning of others

The PD repeatedly emphasizes:

- discussion
 - justification
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- Claim-Evidence-Reasoning (CER)
- explaining mathematical thinking

Students defend classifications using evidence rather than memorized definitions. The original design explicitly incorporates a CER framework and asks teachers to move students from observation to reasoning.

MP4: Model with mathematics

Architecture and sculpture become mathematical models for investigating:

- measurement
 - proportional reasoning
 - geometry
 - estimation
 - optimization
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MP5: Use appropriate tools strategically

Depending on the lesson, students may use:

- rulers
 - graph paper
 - digital images
 - geometry software
 - tracing
 - calculators
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MP6: Attend to precision

The PD explicitly models moving from everyday language to precise mathematical vocabulary (e.g., "curves inward" becomes "concave").

MP7: Look for and make use of structure

Students identify:

- repeated shapes
 - symmetry
 - transformations
 - geometric relationships
 - patterns within complex designs
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MP8: Look for and express regularity in repeated reasoning

Students generalize from multiple examples:

- How do curved surfaces behave?
 - How do proportional relationships appear across different scales?
 - How can repeated geometric structures be described mathematically?
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Connections to Common Core Content Standards

Because the PD is intentionally broad, teachers can adapt it to many middle school units.

Grade 6

Ratios and Proportional Relationships

- 6.RP.A.3: Use ratio and rate reasoning to solve real-world problems.

Examples:

- Scale drawings
 - Comparing dimensions
 - Estimating building heights
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Geometry

- 6.G.A.1: Find the area of polygons.
 - 6.G.A.2: Find the volume of right rectangular prisms.
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Applications:

- Floor plans
 - Sculpture bases
 - Architectural layouts
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Grade 7

Scale Drawings

- 7.G.A.1: Students:
 - analyze architectural drawings
 - enlarge/reduce designs
 - interpret blueprints
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Geometry

- **7.G.B.4:** Circles
 - radius
 - diameter
 - circumference
 - arc length
 - Useful with curved architecture and sculpture.
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Surface Area and Volume

- 7.G.B.6: Students estimate:
 - exterior surfaces
 - materials
 - enclosed space

Grade 8

Transformations

- 8.G.A.1–5: Architecture naturally illustrates:
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- rotations
 - reflections
 - translations
 - symmetry
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Congruence and Similarity

Students compare:

- repeated design elements
 - scaled architectural models
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Volume

- 8.G.C.9: Real-world applications involving:
 - sculptures
 - buildings
 - composite solids