



Presentation

FULL DETAILS AND TRANSCRIPT

Teaching Spatial Skills to Girls

November 2007

Topic: Encouraging Girls in Math and Science

Practice: Teaching Spatial Skills

Highlights

- Boys regularly outperform girls on tests of spatial skills (especially rotating 3-D objects).
- These skills are important in the math and science fields, many professional careers, and everyday life.
- These skills can be taught. Instructional techniques range from encouraging young girls to play with building toys to providing specific instruction in the mental rotation of images.

Full Transcript

Slide #1

Welcome to the overview on teaching spatial skills to girls.

Slide #2

Ms. Lee's geology class is learning about different rock layers below the earth. They're deeply engaged in a class simulation—pretending they're oil prospectors looking for sandstone... The first step involves cross-sectional charts of the rock layers where students need to imagine the shape and location of the sandstone layer.

The boys immediately dive in, but many of the girls are having a difficult time creating a 3-D mental image of the sandstone layer and can't understand how that fits with their existing 2-D chart. It doesn't take long before some of the girls completely give up, happy to let the boys finish the task for them. Clearly, the girls are lacking the spatial skills required in this activity—a common problem throughout the country.

Slide #3

So what are spatial skills, and why are they important? Spatial skills help us visualize two- or three-dimensional objects—skills that are especially important in math, science, and numerous professions.

Slide #4

In math, for example, spatial skills are needed to calculate the height of a mountain or the volume of an unusual shape. According to the National Council of Teachers of Mathematics, enhancing spatial abilities should be one of the primary goals of geometry.

Spatial thinking is also essential for science, because it helps us imagine, represent, and manipulate information—skills required to solve a wide range of problems. For example, spatial skills make it possible to imagine things that aren't visible to the naked eye, like the interactions of molecules.

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Spatial skills are essential to many careers as well. An architect needs to envision a bridge from all angles before it can be built. A geographer needs to translate a topographic map into a visual image of the landscape. And a building manager needs to imagine floor plans for offices.

People also use spatial skills in their every day lives, regardless of their profession. It's how we compare the view from the driver's seat to the route shown on a map, or help us pack a suitcase more efficiently, or judge the distance to the end of a skateboard ramp.

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But why do we need to help girls with spatial skills? Research has found that boys regularly outperform girls on tests involving spatial skills, especially when it comes to "mental rotation"—imagining what an object will look like when it is rotated in space.

For example, the largest disparity between boys and girls on the SAT test is in geometry, where questions rely heavily on spatial skills. Because these items make up about one third of the SAT math section, girls without strong spatial skills are at a considerable disadvantage.

Slide #7

The good news is that these skills can be taught. Children who are taught specific spatial skills not only improve on spatial related tasks, but they also make noticeable improvements in other areas of math and science, such as geology. Early development of spatial skills can deeply impact a child's learning. For example, a kindergartener's ability to pick out different shapes is a predictor of their fourth grade math achievement.

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Strong spatial abilities also influence which courses high school students like best, such as advanced math and science, and play a role in a student's decision to choose careers in math, science, and engineering.

In one case, college engineering students who received spatial skills training earned higher grades in their drafting classes and were more likely to stay enrolled in their engineering program. This was especially true for female students.

Slide #9

How can classroom teachers help students develop better spatial skills?

Let's see how Ms. Lee directly helped her students learn mental rotation...

First, she asked her students to make a "building" out of six cubes. Next, she had them draw the same building on grid paper from three different angles: from above, from the front, and from the left side. This

helped the students envision a 3-D object on a 2-D, paper-based environment—and vice versa.

Slide #10

These same methods can be used by any teacher who wants to help girls learn spatial skills. Specific instructional techniques include:

- encouraging young girls to play with building toys such as Legos, blocks, and Tinkertoys,
- designing tasks that require visual responses, rather than just written or verbal responses,
- and providing specific instruction on mental rotation of images, spatial perspective, and embedded figures.

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The research is clear: girls continue to lag behind boys in the area of spatial skills, especially the visualization of three-dimensional rotating objects. This deficit directly impacts girls' performance in math, science, and other academic areas. Luckily, spatial skills can be learned, and through targeted instruction girls can master these skills just as well as boys—providing a solid foundation for success in math, science, and a wide range of careers.

Slide #12

To learn more about teaching spatial skills to girls, please explore the additional resources on the Doing What Works website.