



Audio

FULL DETAILS AND TRANSCRIPT

Spatial Skills in High School Science and Math

Jeffers High School, Michigan • November 2007

Topic: Encouraging Girls in Math and Science

Practice: Teaching Spatial Skills

Highlights

- This teacher focuses on spatial abilities in her high school classroom. These skills are useful in geometry, statistics and calculus, as well as the real world.
- Making the connection to real-world uses may open students' eyes about potential career choices in fields such as engineering.
- Some girls show particularly strong gains in spatial skills, indicating that they came in with strong math skills but had not had the opportunity to develop their spatial skills.
- Students enjoy the exposure to something so different from what they've done before and enjoy seeing their own skills improve so much.

About the Site

Adams Township School District

Jeffers High School

Painesdale, MI

Demographics

97% White

45% Free or reduced-price lunch

Jeffers High School was among the first schools to pilot a spatial skills program developed under a grant from the National Science Foundation (NSF). The program was developed to promote students 3-D spatial skills to help them perform better in math and science and prepare them for engineering courses in college. The approach to implementation in this school currently includes:

- An elective course for high school students
- Emphasis on hands-on experience
- Combining classroom manipulation (such as building with blocks) with computer exercises.

Full Transcript

My name is Lisa Raffaelli. I work at Jeffers High School in Painesdale, Michigan. We use spatial abilities quite a bit in the mathematics curriculum. The most obvious class would, of course, be Geometry. This course is centered on studying two-dimensional and three-dimensional objects. Often times students are asked to look at a three-dimensional object and talk about its surface area or break it down to its net, which would be its two-dimensional image. But also, in a course like Statistics if you have data, a lot of times there's a spatial component to analyzing data sets. In a Calculus course, students are often asked to take their function and maybe rotate it around an axis and then perhaps find the volume. Or maybe take a slice and look at washers or discs of a solid.

So breaking an object down and being able to manipulate it or rotate it or reflect it is essential in many mathematics courses. Our students often, in Geometry for instance, have to find volume of a shape or maybe the surface area of a shape. So, being able to picture that—and especially going from the three-dimensional to the two-dimensional surface area, for instance in painting a room, even—allows the students to be good consumers in addition to being able to solve just a Geometry problem as they realize how much carpeting they need to buy in order to carpet a room that might have an irregular shape, for instance, or paint a room.

It may open up doors for some of these students to look at fields such as engineering, where they might not even have thought about something like that before. I know also I've had students mention that when they look at molecules in Chemistry, that they have to know how the pieces fit together, and our Chemistry teacher has some of the sets with the balls and the rods where the students put the atoms together to make the molecules. And students have described that as similar to the spatial training that they have done.

One interesting fact with the program that happened last spring, was I happened to have the same group in Algebra I—this was the 8th grade Algebra course that I was also using the spatial skills training with—and

two of the girls that were consistently the strongest students in the Algebra course, didn't do very well on the pre-test for the spatial visualization. We pre-test and then post-test the students just to see how much ground that they've covered. And the girls did not do real well at all on the pre-test on the spatial visualization skills. But after we went through the modules and we took the post-test, these girls actually made the highest gains in the class.

So I guess what that says to me is these girls are very mathematically inclined and very good students, but they did not have an experience or an opportunity to be exposed to developing their spatial skills. But after going through this program, their spatial skills were really enhanced and developed quite a bit.

From my experience, the girls tended to really enjoy working in what we called their partner pair, and we actually came across this quite by accident. What happened is the course was scheduled at a time when there was a lot of computer use already in the buildings, so we had limited access to computers. So instead of every student having their own computer, which was going to be the ideal situation, we had to partner students up to share a computer while they went through the tutorial. But while I was watching the students go through their tutorials, I noticed the positive interactions they were having. How they were asking each other questions, and if they didn't understand something they would ask their partner for clarification. And I decided that I would allow them to work on pairs not only on the computer tutorial, which we had to do because of limited access, but also for the worksheets. And I really enjoyed watching the interactions with the students. They often would ask questions of their partner. And sometimes they were just looking for a small clarification or sometimes just for reassurance, but they almost treated it as more of a social activity and they really enjoyed the computer aspect and the workbook pages, working in the partner pairs.

In fact, I would have some of the students who would stop by my classroom each morning and ask, "Are we doing spatial skills today?" And they would be very excited if my answer was, "Yes, we are doing spatial skills today."

I think part of the excitement with the spatial skills training was not only the technology aspect of it—working with the computers is always fun for the students—but just the fact that this was so different from anything that they've done before. They hadn't had training like this before. And they have the computer aspect, but they also have the drawing, which is almost like an art class. So, you know, a lot of times computers and art are the subjects that the students like the best, so putting those two together was just a real positive thing. And I think they were also very impressed with how much their skills were developing. Some of the students, when they were provided with isometric dot paper on the first day and just asked to draw a cube by connecting dots, could not even draw a cube in three dimensions. And by the end of that day, they're drawing small buildings and they're seeing their progress. So I think the excitement generated—a lot of it—was a result of, "Hey, I can do this. And this is a lot of fun and look at how good I am at this."