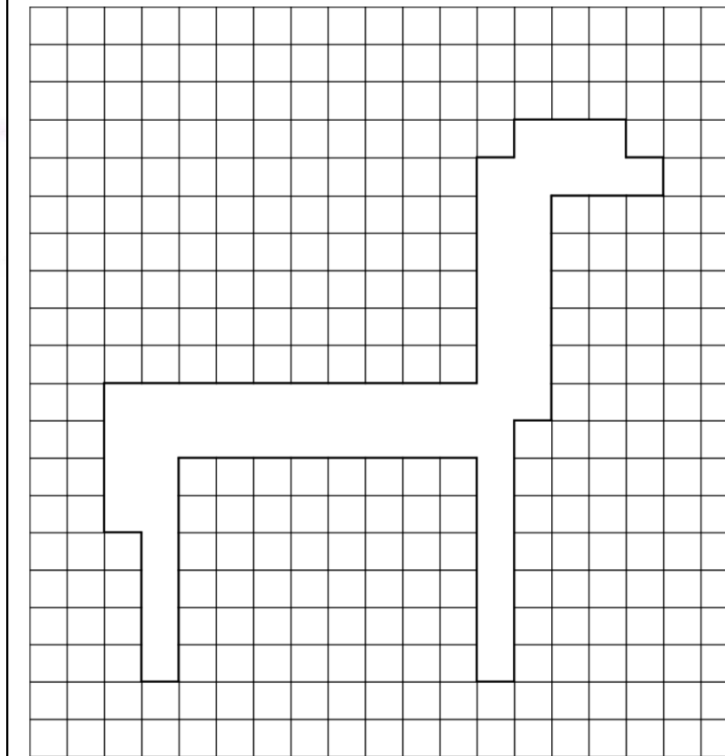


Can You Make Them Fit?



- Cover the Giraffe -



Can You Make Them Fit?

- Cover the Giraffe -



What were you thinking about as you tried to complete the picture?





Beyond Numbers: Building Spatial Reasoning in Children



Dennis McDonald

dmcdonald@hcpss.org

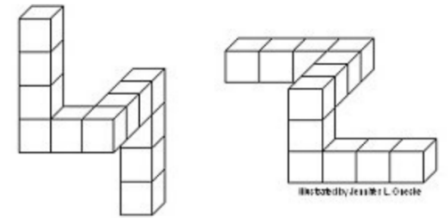
Mathematics Support Teacher
Talbot Springs Elementary

11/14/19



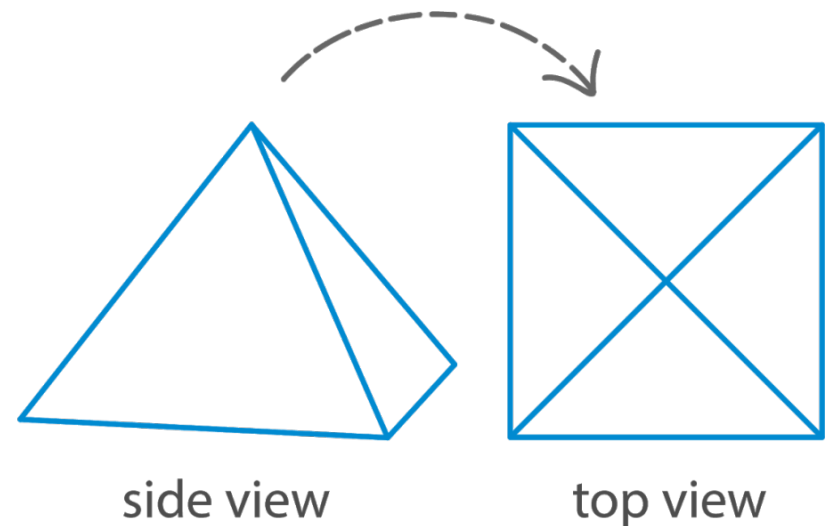
What is Spatial Reasoning?

- **composing and decomposing** shapes and figures
- **visualization**, or the ability to mentally manipulate, rotate, twist, or invert pictures or objects
- **spatial orientation**, or the ability to recognize an object even when the object's orientation changes
- **spatial relations**, or the ability to recognize spatial patterns, to understand spatial hierarchies, and to imagine maps from verbal descriptions



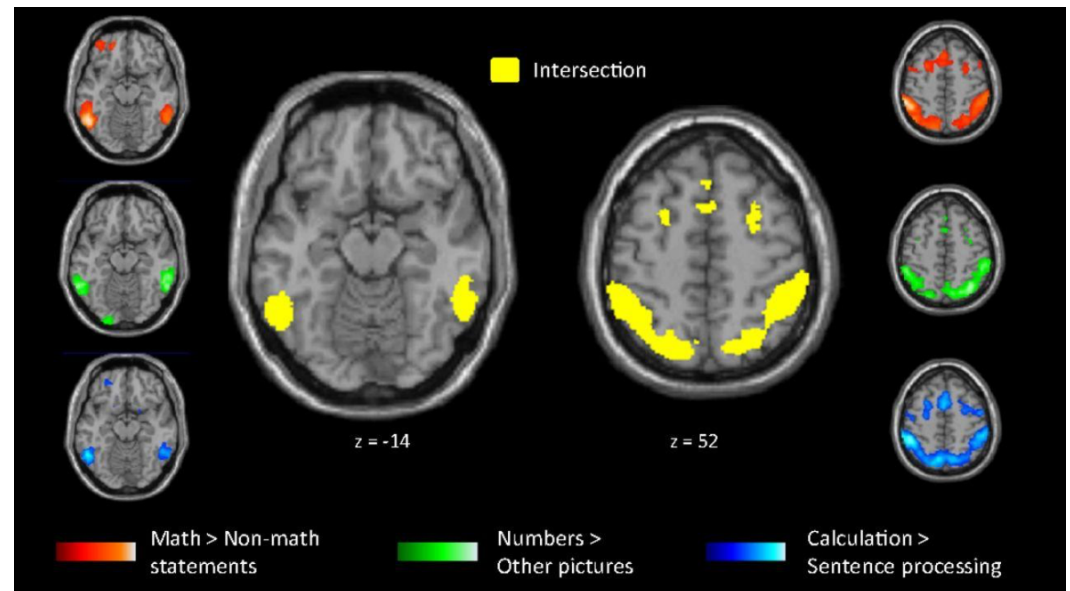
What is Spatial Reasoning?

Spatial thinking is what allows us to mentally “picture the locations of objects, their shapes, their relations to each other and the paths they take as they move.”



Why Emphasize Spatial Reasoning?

“Brain imaging studies confirm that similar areas are activated when people process both spatial and number tasks.”

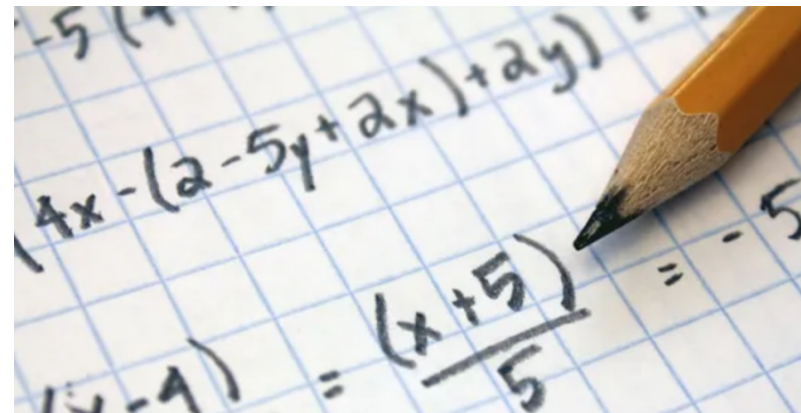


Hubbard et al. (2005)
Umiltà, Priftis, & Zorzi (2009)

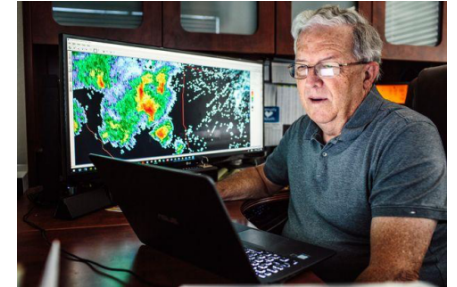
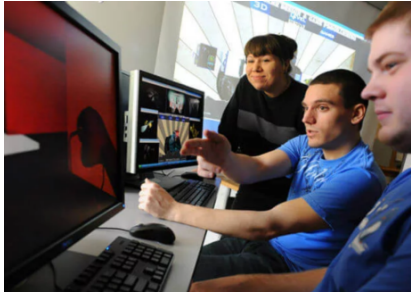


Why Emphasize Spatial Reasoning?

“Students who perform better on spatial tasks also perform better on tests of mathematical ability”

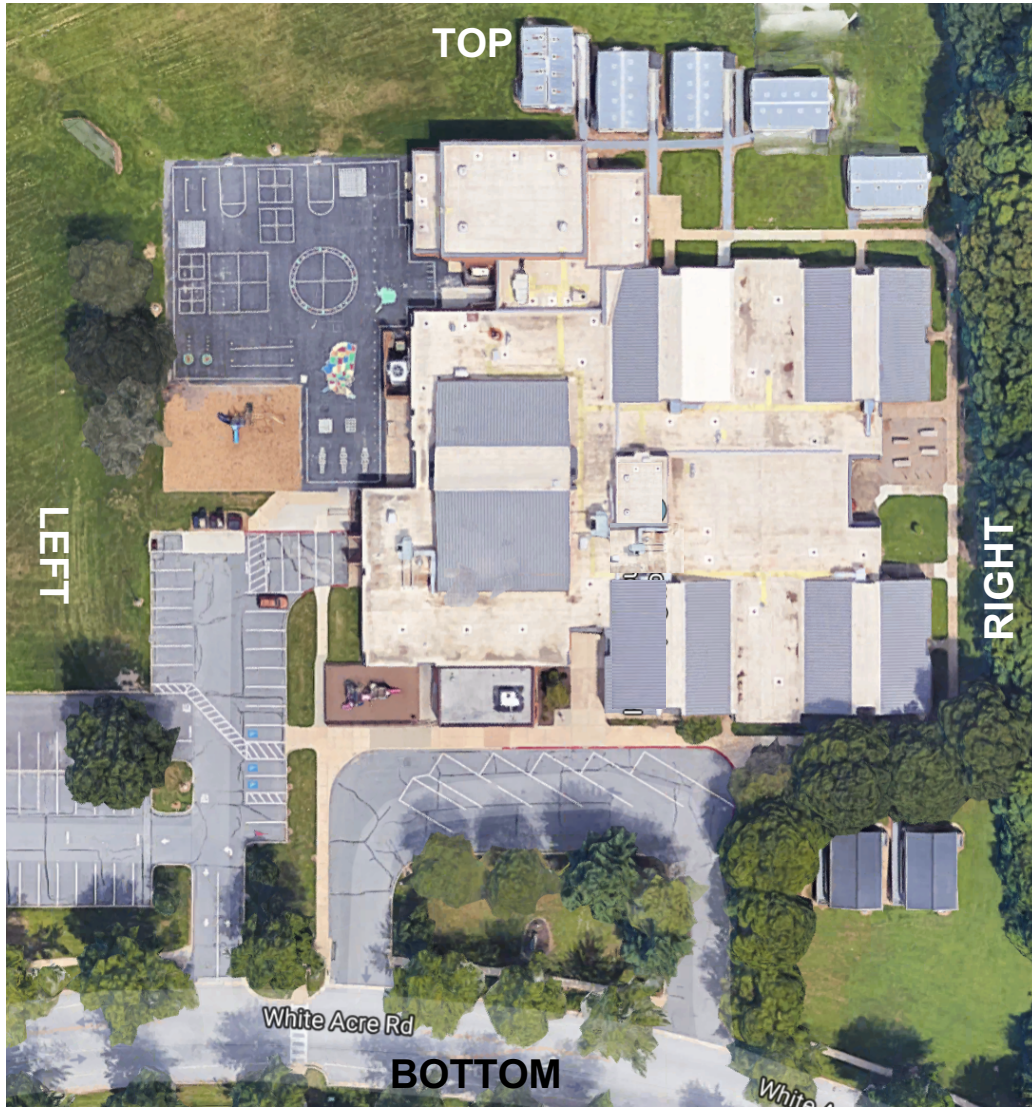


Spatial Ability & Careers



Rich and Brendefur (2018)





**Where on
(Google) Earth
am I?**



Building Spatial Reasoning

- Explore with maps.



Building Spatial Reasoning

- Use spatial talk.



"Which way does the sheet fit on the bed? Does the left shoelace go over or under—and which one is the left? Will the groceries fit in one bag? Which shapes do I get if I cut my bagel the other way—and will it still fit in the toaster?"

– Nora Newcombe and Andrea Frick (2010)



Building Spatial Reasoning

- Encourage gesturing.



[P]eople were better at performing mental rotation tasks (a key measure of spatial thinking) when they were encouraged to use their hands

– Chu and Kita (2011)

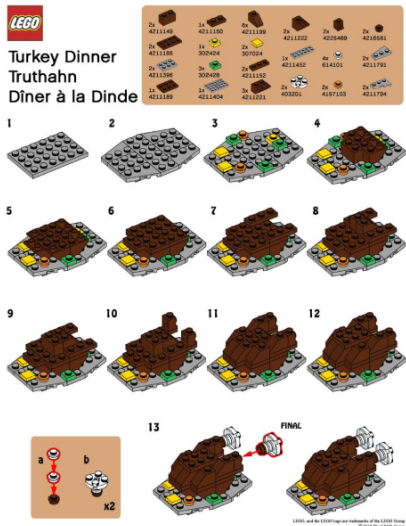
5-year-olds who spontaneously gestured during spatial problem-solving were more likely to get the right answer

– Ehrlich et al (2006)



Building Spatial Reasoning

- Provide opportunities for using building toys and puzzles.



8-year-old children showed measurable improvements in their mental rotation abilities after just five, 30-minute play sessions. Post-training, they also showed changes in brain activity, suggesting that these kids had changed the way they processed spatial information.

– Newman et al (2016)



Building Spatial Reasoning

- Provide opportunities for origami and other paper-folding crafts



For instance, a study of British primary school students found that kids with stronger mental folding abilities scored better on tests biology, physics, and chemistry.

– Hodgkiss, et al (2018)

school children improved their performance on a very challenging mental folding task after just a few hours of instruction in and hands-on exploration of origami

– Burte, et al (2017)



Questions?

