Improving Geoscience Students’ Spatial Thinking Skills: Applying Cognitive Science Research in the Classroom

The Problem(s)

Spatial thinking skills are critical to success in many subdisciplines of the geosciences (and beyond). Undergraduate students in introductory and upper-level geoscience courses bring a wide variety of spatial skill levels to the classroom.

Although pre- and post-test comparisons show that student skill levels typically improve over the course of an academic term, average gains are quite modest.

Research-based Strategies

Cognitive science research suggests strong strategies for building students’ spatial skills. Progressive alignment and gesturing can be used to scaffold understanding. Practice is essential, and time on task is correlated to improvement.

Progressive Alignment

Progressive alignment is the process of moving from the comparison of very similar to less similar objects. Visualizing a slice through the interior of an object requires imagining how it differs from the exterior. If the interior structure varies gradually and regularly, we expect that progressive alignment will help students move from visualizing near-surface slices through an object to visualizing slices farther away from the visible surfaces. We are preparing to test this hypothesis.

Gesturing

Gesturing has proven effective in moving younger students from incorrect problem-solving strategies to correct strategies in other disciplines. We are currently testing whether it can do the same in geoscience. Subjects are asked to gesture (a) how they would make a playdoh model of a block diagram (without any actual playdoh), (b) where they would slice it to see an indicated cross-section, and (c) in what direction they would look at the block model to see the slice.

While we do not yet have enough data to draw any conclusions from these experiments, initial results suggest that this may be an effective strategy for developing geoscience students’ penetrative thinking skills.

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