Students' Spatial Thinking Skills

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Introduction

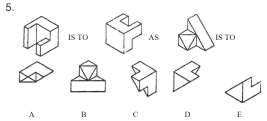
Spatial thinking skills are critical to success in structural geology and tectonics, as well as many other subdisciplines in geoscience (and beyond). For the past two years, we've been testing students' spatial skills in geoscience courses, using several different measures (not all of which are shown here). We seek answers to several questions:

1. What spatial skill levels do students bring to geoscience classes?
2. What are the different components of spatial thinking, and how do they correlate? (If a student excels at mental rotation, will she excel at all spatial tasks?)
3. How do geoscience courses affect students' spatial skills?
4. What can geoscience instructors do to help students develop their spatial thinking abilities?

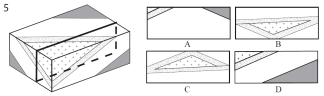
The Tests

Penetrative thinking

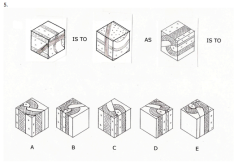
Mental rotation



Block diagrams

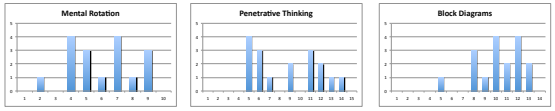


Geological mental rotation

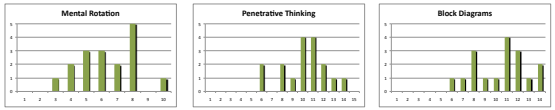


Structure, UW-Madison

Pre-test results

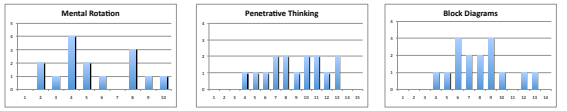


Post-test results

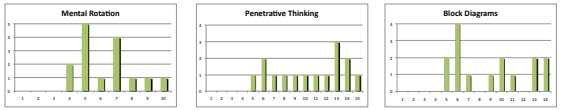


Tectonics, Carleton

Pre-test results

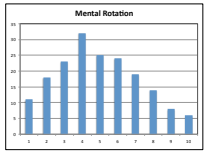


Post-test results

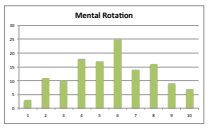


Introductory Geology

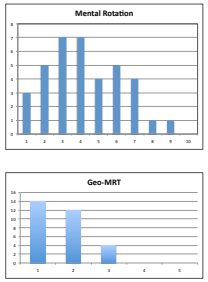
Pre-test results, UW-Madison



Post-test results, UW-Madison



Pre-test, Carleton



Post-test, Carleton

Coming in June

Conclusions & Next Steps

1. Students' skills vary from excellent to almost non-existent on measures of several different spatial thinking skills.
2. While there is some correlation between various spatial skills, an individual student can be very strong at some kinds of spatial thinking and very weak at others.
3. Skills improve only slightly over one term, in both introductory and advanced classes. Some skills improve more than others in a particular course (penetrative thinking in structural geology, for example).

In the next stage of our classroom studies, we will

- Document teaching methods, materials, and in-class time spent on spatial tasks in each class
- Develop new teaching materials based on cognitive science research on spatial thinking
- Compare students' spatial skills improvement relative to various teaching methods and materials