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# The Importance of Spatial Reasoning Skills in Undergraduate Geology Students and the Effect of Weekly Spatial Skill Trainings

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Spatial reasoning is a key skill for student success in STEM disciplines in general and for students in geosciences in particular. However, spatial reasoning is neither explicitly trained, nor evenly distributed, among students and by gender. This uneven playing field allows some students to perform geoscience tasks easily while others struggle. A lack of spatial reasoning skills has been shown to be a barrier to success in the geosciences, and for STEM disciplines in general. Addressing spatial abilities early in the college experience might therefore be effective in retaining students, especially females, in STEM disciplines.

We have developed and implemented a toolkit for testing and training undergraduate student spatial reasoning skills in the classroom. In the academic year 2014/15, we studied the distribution of spatial abilities in more than 700 undergraduate Geology students from 4 introductory and 2 upper level courses. Following random assignment, four treatment groups received weekly online training and intermittent hands-on trainings in spatial thinking while four control groups only participated in a pre- and a posttest of spatial thinking skills.

In this presentation we summarize our results and describe the distribution of spatial skills in undergraduate students enrolled in geology courses. We first discuss the factors that best account for differences in baseline spatial ability levels, including general intelligence (using standardized test scores as a proxy), major, video gaming, and other childhood play experiences, which help to explain the gender gap observed in most research. We found a statistically significant improvement of spatial thinking still with large effect sizes for the students who received the weekly trainings. Self-report data further shows that students improve their spatial thinking skills and report that their improved spatial thinking skills increase their performance in geoscience courses.
We conclude by discussing the effects of the training modules on development of spatial skills, which helps to shed light on what types of interventions may be useful in leveling the playing field for students going into the geosciences and other STEM fields.