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Individual spatial reasoning skills support different kinds of physics tasks

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Abstract

The majority of undergraduate students fail to achieve a basic understanding of fundamental concepts in science, technology, engineering, and mathematics (Bao et al., 2009). A major barrier may be spatial reasoning (Wai, Lubinski, & Benbow, 2009). Spatial reasoning is the ability to mentally manipulate the 2D and 3D relations within and between objects. The current study examines the casual relation between spatial reasoning and performance in an undergraduate introductory physics course. All students enrolled in the course took tests of mental rotation, hidden figures, form board, and perspective-taking at the beginning of the semester and again at the end of the semester. Post-test scores were significantly higher compared to pre-test scores, $t(38) = 10.82$, $p < .02$. Growth in spatial reasoning is predictive of exam performance, with performance on individual spatial reasoning tests being correlated with specific kinds of exam items. This suggests individual spatial reasoning skills differentially support different physics understanding.