Mercredi 30 octobre 2019 à 13h

Salle F28 du Neurocampus
Bat 462 Centre Hospitalier du Vinatier, Bron

Longitudinal Change in Functional Connectivity Mediates Far Transfer from Spatial Education to Relational Reasoning in Real-World Classrooms

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Summary: A substantial gap remains between the way learning is studied in the cognitive neuroscience lab and the way learning is studied where we care about it most: in the real-world classroom. Closing this gap requires treating an in-school curriculum as the intervention and measuring longitudinal neural and cognitive changes associated with what is being taught. To address this gap, we designed a longitudinal study of the effects of a spatially-focused STEM curriculum on the activity and connectivity of "spatial" brain regions and on near, intermediate, and far transfer tasks in a sample of U.S. public high school students. A quasi-experimental design compared students enrolled in the spatially-focused course with selected control students taking other science courses. Behavioral results indicate that that the spatially-focused curriculum lead to increased spatial habits of mind (near transfer), improved spatial search and comparison (intermediate transfer), and improved deductive relational reasoning (far transfer). Convergently, the spatially-focused curriculum was associated with increased recruitment of posterior parietal "spatial" regions during reasoning. Critically, students in the spatially-focused curriculum showed increased connectivity of "spatial" regions to prefrontal regions associated with reasoning, and this increase partially mediated the improvement in reasoning. These data indicate a "spatial" shift in both performance and underlying neural strategy for reasoning. These results were observed despite the use of verbal (rather than visuo-spatial) reasoning stimuli, even when verbal stimuli contained non-spatial relations (e.g., "happier than"). Implications for spatially-based accounts of relational reasoning, and for adoption of spatially-focused STEM education are discussed.